Nutrition and Digestion in Living Organisms

Nutrition:

It is the scientific study of food and various modes of nutrition of living organisms.

Nutrition is needed for:

a- Food materials are the source of energy for all vital processes.
b- Food materials are needed for growth and repair of worn out tissues.

A Types of nutrition

1 Autotrophic nutrition:-

Autotrophs are living organisms which can manufacture their food by themselves e.g. green plants. They can synthesize inside their cells high energy food stuffs as carbohydrates, fats and proteins out of simple inorganic and low energy materials as $\mathbf{CO_2}$and $\mathbf{H_2O}$ in addition to **minerals salts** and **light energy** by a process called **Photosynthesis.**

2 Heterotrophic nutrition:-

Living organisms obtain food from other organisms either plants or animals that werepreviously feeding on plants. In the form of (high energy complex ready organic substances such as protein, carbohydrates and lipids

Heterotrophs are classified into:-
1-Holozoic heterotrophs

- Herbivores: feed on plants
- Carnivores :feed on animal
- Omnivores :feed on both plants and animals

2-parasites

- Bilharzia worms
- Orobanche plant

3-Saprophytes

- Some fungi
- Saprophytic bacteria

Autotrophic nutrition

Nutrition in green plants Include 2 important processes:

1-The process of absorption of water and salt

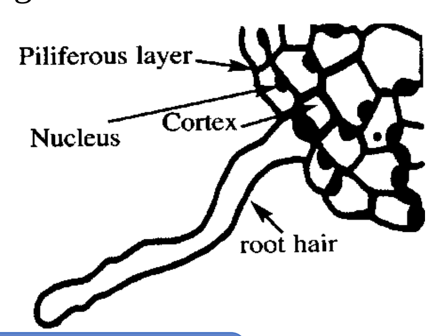
2- The process of photosynthesis.

The process of absorption of water and salts:

Higher plants absorb water and minerals from the soil through root hairs present in the root system. This solution is then transported from one cell to another until reachingthe xylem

B Structure of hair root

1- Each root hair is a tubular outgrowth of an epidermal cell.
2- Root hairs are lined internally with a thin layer of cytoplasm which contain the nucleusand a large sap vacuoles.
3- A root hair may reach 4 mm long.
4- Root hairs don't exist for more than few days or weeks, since the epidermal cells are lostfrom time to time and are regenerated from the zone of elongation.



C Function of the root hair

1- Absorption of water and mineral salts from the soil.

2- Fixation of the plant to the soil.

Suitability of the root hair its function:-

1- They have thin walls to permit the passage of water and salts through them.

2- Large in number and protruding to the outside to increase the surface area of absorption.

3- They have high osmotic pressure: the solution of the cell vacuole is more concentratedthan that of the soil in order to help water to pass from the soil to root hairs.

4- They secrete viscous substance to facilitate their passage among soil particles and help to fix the plant to the soil

D Mechanism of water absorption:-

It depends upon many physical phenomena:

1 The phenomena of diffusion:

Diffusion is the movement of molecules or ions from a high conc. medium to a low conc. one. This is due to the continuous free motion of molecules of the diffused substance e.g. diffusion of a drop of ink when it falls into a beaker containing water.

High conc. **Of molecules or ions** ⟶ Low conc.

2 The phenomena of permeability:

It is the ability of some walls and cell membranes to allow the passage of both water andions through them. So the walls and membranes divided into:

a- **Impermeable:** that impermeable to water and salts ions.

E.g. walls that covered withlignin, suberin and cutin.

b- **Permeable:** that allow both water and salts ions to pass through them.

E.g. cellulosewalls.

c- **Semi-permeable:** that allow the passage of water and controls the permeability of many salts and prevents the others, such a phenomena is called **selective permeability**.

E.g. plasma membrane

Plasma membrane: *it is semipermeable, has tiny pores that control the permeability of substances through it* (has the selective permeability phenomenon)

- **Selective permeability:**

The selective permeable membrane allows the passage of water, controls the permeabilityof many salts but it prevents the permeability of sugars and amino acids because they are large sized molecules.

3 The phenomenon of osmosis:

It is the diffusion of water from a medium with a high conc. of water to another with alow water conc. through a semi-permeable membrane.

The relation between the concentration of solutes in a solution and its osmotic pressure:
Osmotic pressure increases as the concentration of the solutes in the solution increases, directly proportional relation. e.g.)

NOTE:-
- The root hairs of the desert plants (xerophytes) are characterized by high osmotic pressure to absorb water as much as possible from the soil.
- The normal plants have law osmotic pressure.

Osmotic pressure:
The pressure that causes the diffusion of water through semi-permeable membrane. The osmotic pressure increases by an increase in the conc. of solutes (salts) in water.

4 Imbibition phenomenon

It is the ability of solid particles especially colloidal ones to absorb liquids, swell andincrease in volume e.g. cellulose, pectin and proteins of protoplasm

E Absorption of water by root:-

1-The outer surface of root hair are covered by colloidal layer that will **imbibe** water from the soil solution by **imbibition** and also the cellulosic walls will imbibe water from the soil solution.

2-The imbibed water is then passes to the inside of the epidermal cells by osmosis due to the difference between the higher conc. of sugar in the cell sap and the lower conc.of soil solution due to the difference in water conc. which is higher in soil solution than in the cell sap

3- Water moves by the same method to the cortex until it reaches the xylem vessels in the Centre of root

Summary:-

Pathways for passage of water from the soil to the xylem vessels:
Scientific researches proved that absorbed water passes across the root cells, until itreaches xylem vessels through 3 pathways:

1- Through **cell sap** by osmosis that needs a gradual fall of osmotic pressure along the rootcells.
2- Through **cell walls** and through the small **intercellular spaces** by imbibition.
3- Through the **cytoplasm** where the water rushes from one cell to another throughthe **plasmodesmata** which connect the protoplasm of the plant cells together.

F Absorption of mineral salts

The plant needs carbon, hydrogen and oxygen beside other essential elements, they aredivided into 2 groups

Macro-nutrients	Micro-nutrients
The plant need to these elements in considerable quantities They are 7:- (Nitrogen- Phosphorus-Potassium-Potassium-Calcium-Magnesium-Sulphur and iron)	The plant needs these elements in very small quantities (Not exceed few milligram/liter), so they are called **trace elements**. They are 8 (Aluminium-Boron-Zinc-Manganese-Chlorine-Copper-Molybdenum andIodine) These elements help to activate enzymes.

Notice: Deficiency of macro and micro- nutrients would lead to:a- Disturbance in plant growth which may even stop completely. Stop production of flowers or fruits.

G Mechanism of absorption of minerals:

1 Diffusion phenomenon

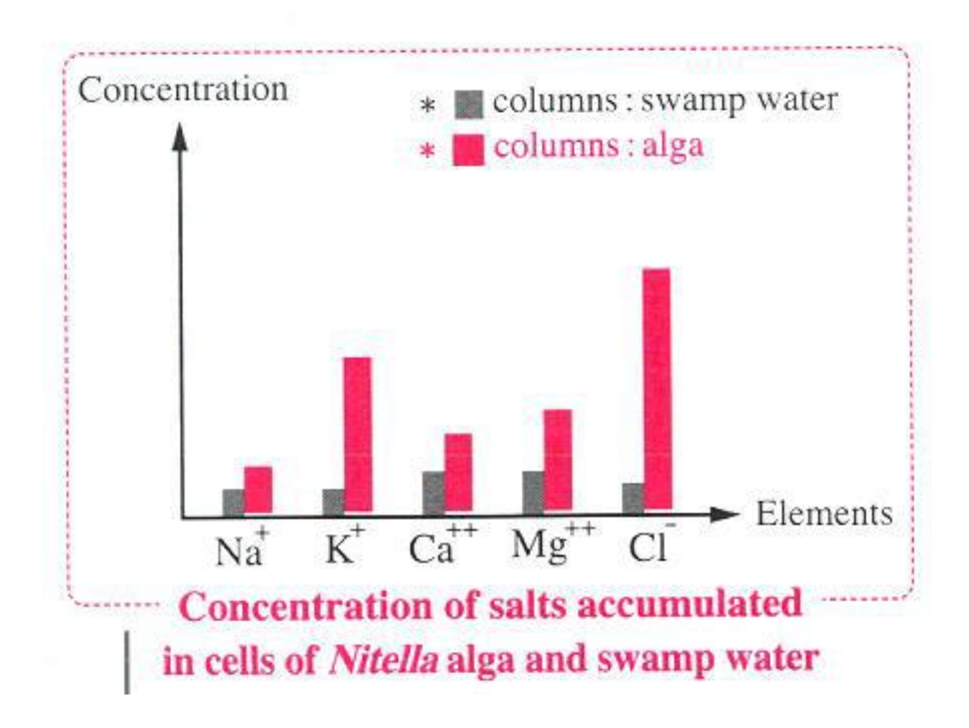
1- Ions diffuse independent of each other and of water in the form of: - Positive ions: cations (K^+,Ca^{++}) - Negative ions: anions (SO_4^{--}, NO_3^- and Cl^- , NO_2^-).
2- These solutes move **by diffusion** from the soil solution and pass through the wet cellulose wall.
3- Cations exchange may take place e.g. Na^+ may get out of the cell and is replaced by a K^+ ion .

2 Selective permeability

When ions reach the plasma membrane (semi permeable), some of them are selected and allowed to pass inward while others are prevented, regardless to their size, concentration or charge, according to the plant's requirements.

3 Active transport:

Ions accumulate inside the cells against the concentration gradient i.e. the ions diffuse from the soil solution of low concentration to the inside of the cell of high concentration; this process needs energy and is called active transport**.**



Concentration of salts accumulated in cells of *Nitella* alga and swamp water

Target: To prove the active transport and selective permeability.
Experiment: The concentration of some ions are measured in the cell sap of the Nitella alga and in the swamp water the alga live in

. **Observations**:
The following graph represents the results of an experiment.

Conclusions:
1. The concentration of ions in the cell sap of the algal cells **is higher** than their concentration in the swamp water.
This proves that the cell must use up energy to absorb these ions. (**Active transport**)
2. The concentration of some ions in the algal cells **is higher** than the concentration of other ions.
This proves that ions are selectively absorbed according to the requirements of the plant. (**Selective permeability**).

Work sheet (1)

1- The food substances that are synthesized inside the cells of the green plant are characterized by being…………….compounds.

(a) High-energy and simple-structured

(b) low-energy and simple-structured

(c) High-energy and complex-structured

(d) low-energy and complex-structured

2- Heterotrophs are characterized by all the following, except that they

(a) Obtain their food in the form of organic compounds.

(b) Obtain their food in the form of high-energy compounds.

(c) Obtain their food in the form of simple-structured compounds.

(d) Depend on other organisms to obtain their food.

3- If you know that Ascaris worms live and feed inside the human small intestine. So, these organisms are…………….

(A) Parasites.
(b) Autotrophs.

(c) Saprophytes.
(d) Carnivores.

4- Which of the following organisms is different in the mode of nutrition?

(a) Bread mould fungus.
(b) Human.

(c) Deer.
(d)Lion.

5 -The following table shows the way of obtaining food for three living organisms:

Organism (X)	Takes simple raw materials from the environment and converts them into complex organic substances
Organism (Y)	Lives inside the alimentary canal of another organism and feeds on the digested food of this organism
Organism (Z)	Lives growing in the places that are rich in organic substances.

Which of the following choices can represent the organisms (X), (Y) and (Z) respectively?

(a) Bilharzia worm/ Mushroom fungus / Corn plant.

(b) Bilharzia worm / Corn plant / Mushroom fungus.

(c)Corn plant / Bilharzia worm / Mushroom fungus.

(d) Con plant / Mushroom fungus / Bilharzia worm

1"Cotton plant is autotrophic, while bread mold fungus is heterotrophic". Explain.

2 -What is the difference between: bean plant and Orobanche plant?

3-The root hair works as an osmotic instrument". Explain.

4-Active transport is arisen from the osmosis difference among the plant cells". How far this statement is correct? With explanation.

5-Give reason for: the cell consumes energy to absorb the ions against the concentration gradient.

Work sheet (2)

1- **If the concentration of K ions in the pond water is 1.2 x 10^3 ion/liter. So, The concentration of these ions in the cellular sap of Nitella alga is** ....

(A) 2.1 x 10^3 (b) 0.12 x 10^3

(C) 0.8 x 10^3 (D) 1.2x 10^3

2- **In the opposite graph:**

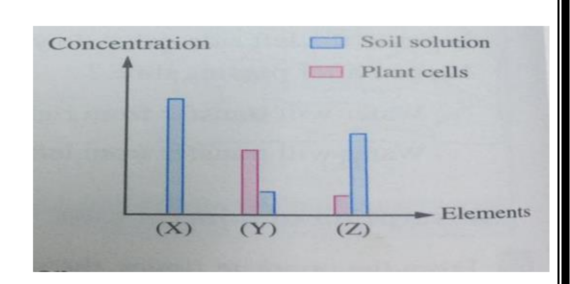
(1) Element (X) is not absorbed, because.........

(a) Its size is big.

(b) Its concentration is very high in the soil.

(c) The plant doesn't need it.

(d) This element from micro-nutrients



(2) The plant depends in the absorption of element (Z) on................

(A) Imbibition. (b) Active transport.

(c) Diffusion. (d) Osmosis.

(3) The plant depends in the absorption of element (Y) on ....

(a) Diffusion. (b) Osmosis.

(c) Imbibition. (d) Active transport.

(4) If you know that in case of the absence of element (Y), photosynthesis process wouldn't occur. So, it is possible that element ((Y) is ………element.

(a) Sulphur (b) Iron

(c) Nitrogen (D) Calcium

(5) The presence of element (Y) in a higher concentration than that of element (Z) in the plant cells confirms that ……..

(a) The plant needs element (Y) more than element (Z).

(b) The absorption of the two elements is occurred by diffusion.

(c) The first element is absorbed by diffusion and the second is absorbed by Active transport.

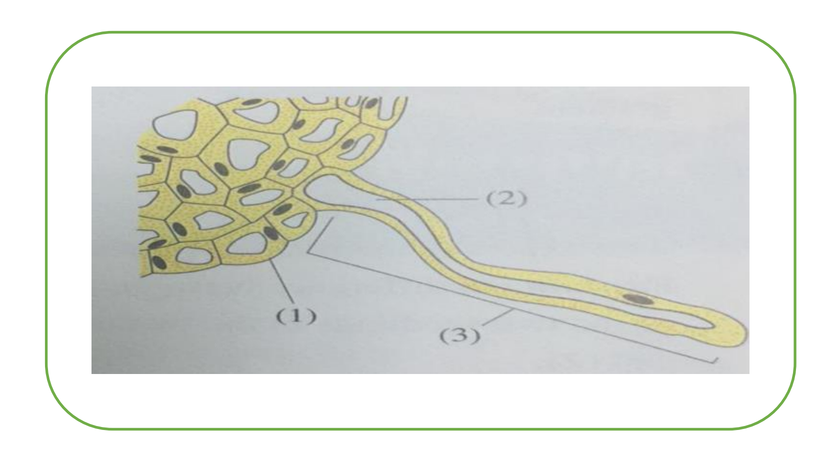
(d) The first element is absorbed by active transport and the second is absorbed by diffusion.

3- Which of the following elements is needed by the plant to absorb ions against the concentration gradient?

(a) Chlorine, (b) Iron.

(c) Phosphorus (d) sulphur

1- **The following figure illustrates an important structure in the plant root:**



(a) What is the change that may occur to structures no? (1) And (3) in case of The continuous root growth?

(b) What happens to the ions concentration in structure no? (2), on increasing the time between irrigation periods?

(c) Predict what happens in case of absence of structure no. (3) From the plant root.

2-The cell walls are characterized by the selective permeability phenomenon". How far this statement is correct? With explanation.

3-What is the relation between: osmosis phenomenon and osmotic pressure?

Photosynthesis in green plants

- **Green leaves** are the main centers for photosynthesis in higher plants as they contain chloroplasts.
- **Green herbaceous stems:** perform photosynthesis, as they contain collenchyma's cells which have chloroplasts.

A Chloroplast Structure:-

1-Under the light microscope:

It appears as a homogenous mass in the form of a convex lens.

2- By the electron microscope:-

It appears to be formed of:

1 Double thin membrane:

Its thickness about 10 nm.

2 Stroma (Matrix):

Colourless, protein substance, contains starch granules and Grana.

3 Starch granules:

Large in number and minute in its size, they are decomposed into simple sugar to be translocate to other organs of the plant under certain conditions.

4 Grana:-

- They are disc shaped granules embedded in the stroma.
- Each granum is about 0.5 micron in diameter and about 0.7 micron thick.
- Each granum (granule) consists of 15 or more discs arranged over each other.
- Each disc is hollow from the inside, while its margins extend outside the granum) to meet the margins of another disc in a

neighbouring granum to increase the exposed area of the granum to light.
- They contain pigments which absorb light energy needed for photosynthesis

B Pigments of the chloroplast:

The pigment	The colour	The percentage
Chlorophyll A	Blue green	70%
Chlorophyll B	Yellow green	
Xanthophylls	Lemon yellow	25%
Carotene	Orange yellow	5%

- Chlorophyll (A) and (B) are considered from the main pigments that are responsible for absorbing most of light for accomplishing the photosynthesis process

- Xanthophyll and carotene are considered from the accessory pigment that absorb a little amount of light than transfer it to chlorophyll (A) which increase the efficiency of photosynthesis process

Importance of chlorophyll:-

It absorb the light energy required for the photosynthesis process

Structure of chlorophyll:-

The molecular formula of chlorophyll is $C_{55}H_{72}O_5N_4Mg$.

Note:-

It is believed that the ability of chlorophyll molecule to absorb light is due to: the presence of Mg atom in its centre.

C Structure of the plant leaf:-

The leaf consist of three main tissue which are:-

1- The upper and lower epidermis

2- Mesophyll tissue

3- Vascular tissue

1 The upper and lower epidermis:

- Each of the 2 layers consists of: one row of adjacent barrel shaped parenchyma cells with no chlorophyll. - Stomata are present and abundant on the lower epidermis.
- The external wall of cells is covered by a thin layer of cutin (to prevent water loss) except stomata.

2 Mesophyll tissue:-

-It lies between the upper and lower epidermis and Trans versed by veins.
- It consists of palisade tissue and spongy cells.

Palisade tissue:	**Spongy layer:**
• Perpendicular to the upper epidermis • It consist of. One row of cylindrical and elongated parenchyma cells. • Cells are filled with chloroplasts, especially its upper part, to receive the highest light intensity.	• It lies below the palisade tissue. • Several rows of irregularly shaped and loosely arranged parenchyma cells. • Cells have wide intercellular spaces. - Contain lower number of chloroplasts than the palisade tissue.

3 Vascular tissue:-

It contains vascular bundles that extend through the veins and venules, the main vascular bundle is found in the midrib

- **The vascular bundle consists of**:-

- **Xylem vessels :**(toward the upper epidermis) - Several rows that are separated by parenchyma cells called xylem parenchyma

- . **Phloem**: (toward the lower epidermis) - Translocate the dissolved organic food from the mesophyll to other parts of plant

D Mechanism of photosynthesis

Sources of oxygen evolved during photosynthesis process:-

The American scientist Van Neil pointed to the role of light in Photosynthesis by studying photosynthesis in green and purple bacteria.

1-The green and Purple bacteria: -

It's characterized by:-

- they are Autotrophic, where they contain bacteriochlorophyll which is simpler in structure than normal chlorophyll
- Live in swamps and ponds, where H_2S is abundant they use H_2S as a source of hydrogen to reduce CO_2 to form carbohydrates while sulphur is released
- **In green and purple bacteria:**

1-Light decomposes **H_2S** into hydrogen and sulphur in light reactions

2-resulted **hydrogen** reduce CO_2 to form carbohydrates in dark reactions while sulphur is released

- General equation of photosynthesis in bacteria:

$$6CO_2 + 12H_2S \xrightarrow[\text{Simple chlorophyll}]{\text{Light energy}} C_6H_{12}O_6 + 12S\downarrow + 6H_2O$$

2- In green plants:

1- Light decomposes **H_2O** into hydrogen and oxygen in light reactions.

2- Resulted **hydrogen** reduce CO_2 to form carbohydrates in dark reactions while oxygen is liberated.

- General equation of photosynthesis in plants:

$$6CO_2 + 12H_2O \xrightarrow[\text{Normal chlorophyll}]{\text{Light energy}} C_6H_{12}O_6 + 6H_2O + 6O_2$$

- **A group of scientists of California university 1941:-**

They carried out an experiment to verify Van Neil assumption:
- They used a green alga (*Chlorella*) and provided it with all conditions favourable for photosynthesis.

- **The 1st experiment:**

They used water contains an oxygen isotope O^{18} instead of the normal oxygen O^{16}.

Observation:

The released oxygen was O^{18}.

The general equation:

$$6\,C\,^{16}O_2 + 12\,H_2\,^{18}O \xrightarrow[\text{Chlorophyll}]{\text{Sun Light energy}} C_6H_{12}\,^{16}O_6 + 6\,H_2\,^{16}O + 6\,^{18}O_2$$

- **The 2nd experiment:**

They used ordinary water with Carbon dioxide containing the isotope Oxygen (O18).

Observation:

The released oxygen was O^{16} not O^{18}

The general equation:

$$6\,C\,^{18}O_2 + 12\,H_2\,^{16}O \xrightarrow[\text{Chlorophyll}]{\text{Sun Light energy}} C_6H_{12}\,^{18}O_6 + 6\,H_2\,^{18}O_6 + 6\,^{16}O_2$$

Conclusion:-

The source of liberated oxygen is water not CO_2

E Photosynthesis reactions

The scientist Blackman:
- Studied the limiting factors of photosynthesis, such as light temperature and **CO_2**.
- He concluded that photosynthesis of two types of reactions:-

1. Light reactions
2. Dark reactions

1 Light reactions

They are a group of reactions that occur in the grana inside the green plastid where the light is the limiting factor for the rate of these reactions

- Light reaction occur in a chain of steps as follows:-

1-. When light falls on chlorophyll of the grana inside the chloroplast, some electrons in the atoms of chlorophyll molecule gain light energy.

2-. These electrons are shifted up from their low energy levels to higher ones. So, the kinetic light energy is stored as potential chemical energy in the chlorophyll. Molecules of chlorophyll are therefore said to be in an ''excited'' or ''activated'' state

3- When the stored energy is released, the electrons fall once more to the lower energy levels. So, the chlorophyll returns to the stable state ready to receive another influence of light, to become excited once more.

4-. **Part of the energy** released from chlorophyll is used in **splitting up** water molecules into Hydrogen and Oxygen.

- . **Hydrogen** resulting from decomposition of the water molecules combines with a co-enzyme present in the chloroplast which is called NADP which is a Hydrogen receptor

- $NADP + H_2 \longrightarrow NADPH_2$.

- **Oxygen** releases as a secondary -product for the decomposition

5- **Another part of the energy** of the excited chlorophyll is **stored in ATP** (Adenosine Tri-Phosphate) {ATP is the result of combination of ADP (Adenosine Di-Phosphate) molecule with phosphate group, this process called ''photosynthetic phosphorylation''

- $ADP + P \longrightarrow ATP$ (energy currency)

2 Dark reactions (Enzymatic reactions)

A group of reactions that takes place in the stroma of the chloroplast outside the grana, **in which the temperature is the limiting factor for the rate of these reactions**

- In this reactions CO_2 gas is fixed by Hydrogen carried on $NADPH_2$ into carbohydrates with the help of the energy stored in ATP molecules. Therefore carbohydrates are formed

F Experiment to prove the nature of the dark reactions:

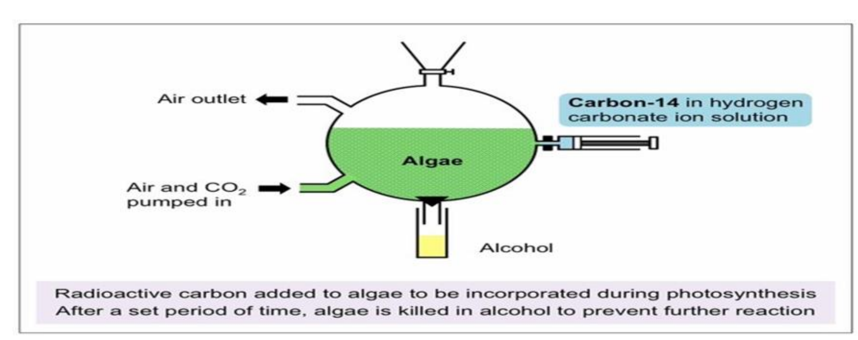
Melvin Calvin and his associates in California University revealed together the nature of dark reactions by using the radio-active isotope C^{14}:

A- They placed the chlorella alga in the apparatus shown, and supplied it with CO_2 gas containing radio-active C^{14}

B- A lamp was lighted very briefly in order for photosynthesis to take place

C- The chlorella alga is then immersed in a beaker containing hot alcohol to kill the alga and to stop the biochemical reactions.

d. They separate the product of photosynthesis by special means, and they tested the presence of radio-active C^{14} in these products.



The results:

1-When photosynthesis is proceeded with the briefest flash possible of light, the 1st stable compound to be produced is PGAL (Phospho-glyceraldehyde)

2- The Hexose's sugar is formed throughout several enzymatic intermediate reaction

Work sheet (1)

1- The stems of herbaceous plants are characterized by the presence of Tissues, Comparing with the stems of perennial trees…………….

(a) Collenchyma (b) Parenchyma

(c) Sclerenchyma (d) chlorenchyma

2 When exposing a plant to a sunny day, which of the following its releasing rate increases from the leaf?

(a)CO_2 (b) H_2

(c)N_2 (d) O_2

3-When exposing a plant to a long period of darkness, which of the following its releasing rate increases from the leaf?

(a)CO_2 (b) N_2

(c) H_2o (d) O_2

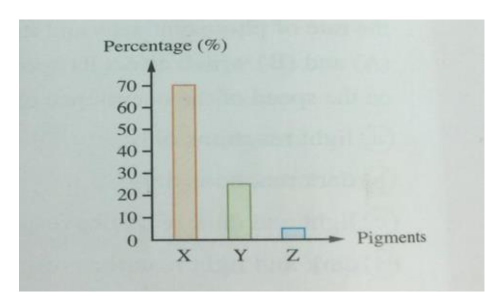
4 -The opposite graph shows the percentages of pigments Percentage Inside plant plastids, which of them is the most abundant in apricot plant fruit?

(A) Z

(b) Y

(c) X and Z

(d) Y and Z



5 The walls of the epidermal cells in a leaf of a plant are impermeable to water, due to the deposition of

(a) Cutin. (b) Cellulose.

(c) Pectin. (d) Suberin

1-Give reason for: the stem of Corchorus olitorius "mulukhiyah" plant has the ability to make photosynthesis process.

2-What happens in case of: the absence of grana from the chloroplasts in a plant?

3-What is the relation between: the molecular structure of chlorophyll and the efficiency of photosynthesis process?

4-What happens in case of: the absence of phloem tissue from the plant leaf?

Work sheet (2)

1- The light passes inside the plant leaf through the……………………

(A) layer that contains air chambers.

(b) Layer that is rich in plastids.

(c) Layer that is impermeable to water.

(D) Layer that contains vascular tissues.

2- Which of the following symptoms appear on growing the plant in a soil poor in magnesium element?

(a) Small leaves and many roots grow.

(b) Large leaves and few roots grow.

(c) The leaves are getting greener.

(d) The leaves are getting more yellow in colour.

3 -If you know that the Medicago stevia plant is the host of the Cuscuta plant. So, we conclude that

(a)The Medicago sativa plant is devoid of chlorophyll and the Cuscuta plant contains real roots.

(b) The Cuscuta plant is devoid of chlorophyll and the Medicago sativa plant contains real roots,

(c) The Medicago sativa plant contains chlorophyll and the Cuscuta plant contains real roots.

(d)The Medicago sativa plant is devoid of chlorophyll and the Cuscuta plant is devoid of roots.

4- The green plants can't survive in far depths of oceans, because…………

(a) There is no suitable soil to fix the plant roots.

(b) The concentration of oxygen is very high.

(c) The light intensity is very low.

(d) The concentration of carbon dioxide is very low.

5-In the photosynthesis process, the green plants use…………….

(a) Carbon dioxide and water to produce energy.

(b) Oxygen and water to produce energy.

(c) Energy to produce carbon dioxide and water.

(d) Energy to produce oxygen, water and glucose.

6-What is the factor that doesn't affect the rate of photosynthesis in the plant?

(a) The number of plastids.

(b) The site of stomata.

(c) The thickness of the mesophyll tissue.

(d)The concentration of chlorophyll.

7- The opposite process to the photosynthetic phosphorylation process is the production of.....

(a) ATP from ADP in grana.

(b) ADP from ATP in grana.

(c)ATP from ADP in stroma.

(d)ADP from ATP in stroma.

8- What is the main function of dark reactions in the green plastid?

(a) Usage of NADPH, to release CO_2

(b)Usage of ATP to release CO_2

(c)Formation of simple sugars.

(d)Splitting of H_2o to release O_2

9-The reduction reactions occur inside the chloroplast in the…………

(a) Stroma. (b) Grana.

(c) Grana and stroma together. (d) Double membrane.

10-The presence of NADPH, compounds in the stroma of the chloroplast is related to the occurrence of all the following, except the............

(a) Splitting of water molecule.

(b) Releasing of oxygen gas.

(c) Formation of ADP

(d) Activation of chlorophyll

1-"Oxygen is always resulted from the photosynthesis process in the autotrophic Organisms". How far this statement is correct? With explanation .

2- "All types of bacteria are autotrophic organisms".
How far this statement is correct? With explanation.

3-"'Scientists used some isotopes in illustrating the mechanism of photosynthesis processes How far this statement is correct? With explanation.

4- "The plant dark reactions don't need co-factors"
How far this statement is correct? With explanation.

5-What happens in case of: exposing sulphur bacteria to a decrease in hydrogen sulphide?

Heterotrophic nutrition

A Digestion:-

It is the conversion of the large food substances (polymers) into small ones (monomers) by hydrolysis, this process is catalyzed by enzymes

1 Importance of digestion:-

The breaking down of the large and complex –structured food substances into simpler structured and smaller –sized molecules which are easily absorbed by the diffusion or active transport

Protein ⟶ amino acid

Carbohydrates ⟶ monosaccharaides

Fats ⟶ fatty acid+ glycerol

Enzyme:-

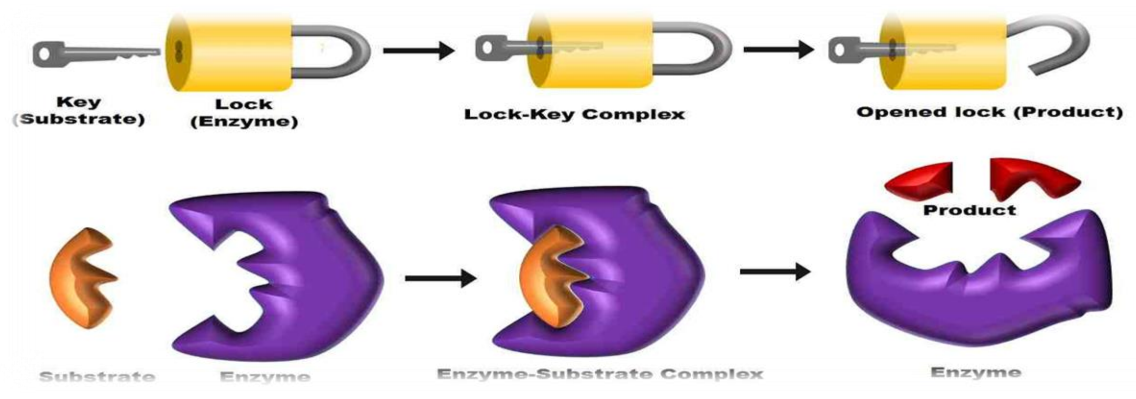
It is a protein substance which has the properties of a catalyst, as it has specific ability to activate a particular chemical reaction.

2 Mechanism of enzyme action

1 - The catalytic chemical reaction depends on the structure of the reacting molecule and the nature of the enzyme.

2-The enzyme reacts with the reacting substance forming an intermediate compound

3-When the reaction is completed, the resulting molecules break away) from the enzyme leaving it in the same form.



3 Properties of enzymes:-

1- They are specific. Because each enzyme accelerates only one type of reactions.

2- They do not affect the products of the reaction
As they work as catalysts which increase the rate of the reaction until it reaches the equilibrium

3- Some enzymes have a reversible effect
As the same enzyme, that catalyzes the hydrolysis of a complex molecule into two simpler molecules, can re-join the simpler molecules to form the complex one again.

4- The activity of the enzyme is affected by Temperature and pH of the reaction.

5-Some enzymes are secreted by the cells in an inactive state so they need certain substances to activate them. e.g.) Pepsin enzyme of the stomach is secreted in an inactive form, pepsinogen, and then it is activated by HCl.

B Digestive system in Human

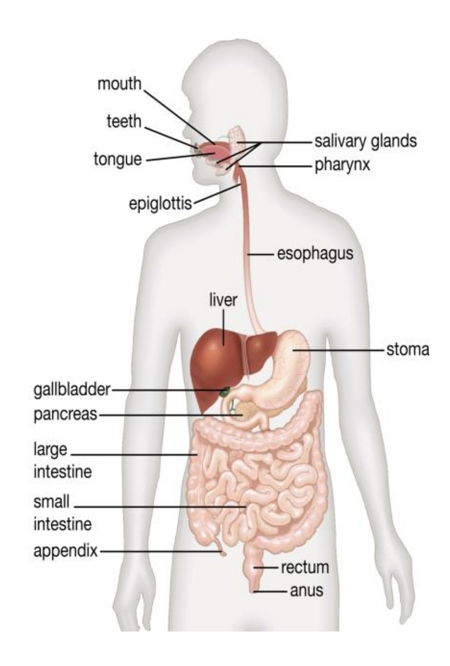
The digestive system consist of:-

(1)Digestive (alimentary) canal

- Mouth
- Pharynx
- Esophagus
- Stomach
- Small intestine
- Large intestine
- Rectum
- Anus

(2)Associated glands

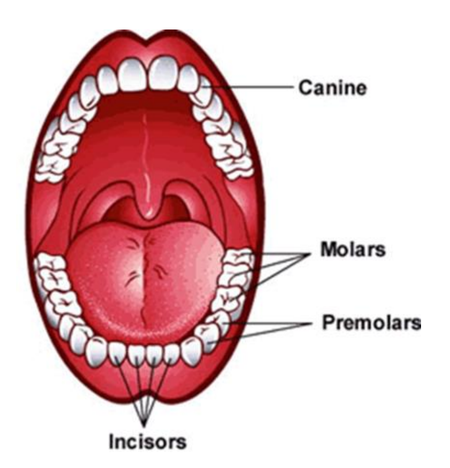
- Salivary gland
- Liver
- Pancreas



1 Mouth

The mouth contains:

(A)Teeth



Incisors: for cutting food
Canines: for tearing food,
Premolars and molars:
(For crushing and grinding food.

(B)The tongue

- Organ of taste
- Helps in manipulating food and mixing it with saliva to be chewed by the teeth

(C) Salivary gland

They are three pairs of salivary glands which open in the mouth cavity through ducts to secret the saliva that contain

- **Mucus**:
  It mixes with food and facilitates its movement through the digestive tract.

- **Amylase enzyme (Ptyalin)**:-
  It catalyzes the hydrolysis of starch into disaccharide maltose.

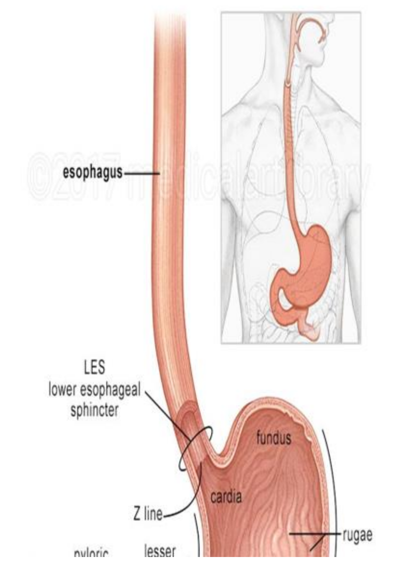
2 Pharynx

- *It is a cavity at the back of the buccal cavity. It is a common passage for air and food.* **Swallowing: -**
- It is a cavity at the back of mouth which lead to two tubes esophagus And Trachea

- **Swallowing process**

It is an organized reflex action, when food is pushed from the mouth to the oesophagus, the top of the trachea together with the larynx is elevated causing the epiglottis to close over the glottis (entrance to the air passage).

3 The oesophagus



- **Extension:-**

- extend from the pharynx downward through
The neck, parallel to the vertebral column into
The chest cavity. It is a 25 Cm. long

- **Secretion**

- It is lined with glands secreting mucus.
- It does not secrete enzymes.

- **Medium:** Alkaline

- **Functions**



1-It is lined with glands secreting mucus which it mixes with food and facilitates its movement through the digestive tract.

2-Food is carried through the oesophagus to the stomach by a phenomenon called peristalsis.

Peristalsis:-
- *It is a series of a rhythmical muscular contractions and relaxations that extends along the alimentary canal.*
- *It is responsible for pushing food through different parts of the alimentary canal and also it is responsible for churning* the *food and mixing it with the digestive juice*

4 Stomach

1-It is a dilated muscular sac.
2- It is joined to the lower part of the oesophagus by
A circular muscle called the cardiac sphincter.
3- It is joined to the small intestine by a circular
Muscle called the pyloric sphincter.

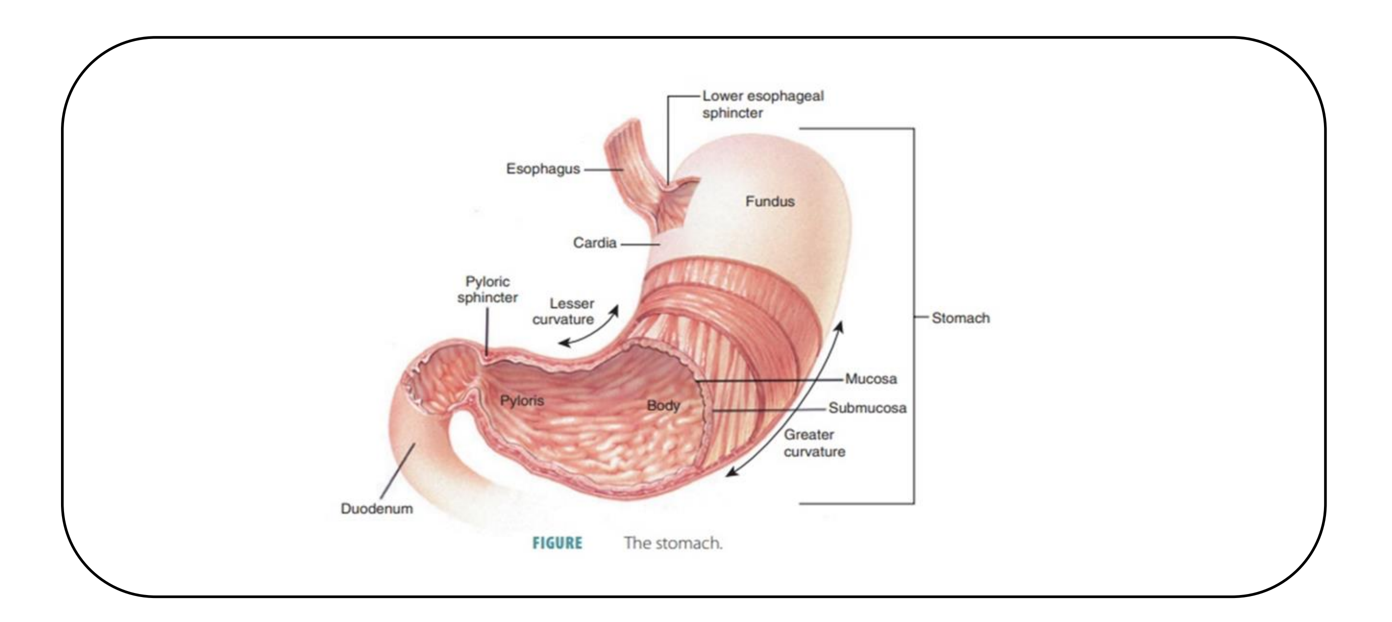


FIGURE The stomach.

- **Function :** It secret the gastric juice:

It is a colourless, acidic liquid, which consist of:-

*1- **Water** :- with a percentage of 90%*

2- Hydrochloric acid (HCL)

It create an acidic medium (PH =1.5: 2.5) inside the stomach to

- *Stopping the action of ptyalin enzyme*
- *Killing the harmful bacteria that may enter with the food*

3- Pepsin enzyme

*Is secreted in an active form called (***Pepsinogen**) and it is activated by the action of HCL acid to digest protein

Protein digestion:-

The active pepsin enzyme catalyzes the hydrolysis of protein by breaking certain peptide bonds in the long chains of protein to convert them into smaller chains of polypeptide

Why does the gastric juice not affect the epithelial cells of the stomach?

1-The presence of mucus secretions which protect the cells against the effect of the digestive enzymes.

2- **Pepsinogen** (inactive) will be activated only when it is mixed with HCl in the cavity of the stomach.

5 Small intestine:

It is formed of two parts, **the duodenum** and **the ileum**.

- **Its length**: 8 meters, its diameter: 3.5 cm. at its beginning and 1.25 cm. at the ending.
- **Its coils and loops**: are connected together by **the mesentery**

.

- **Its juices**: Three juices help to digest food in the small intestine (**bile juice, pancreatic juice and intestinal juice**

Note:-

- The presence of the small intestine is restricted in a small area from abdominal cavity due to the presence of many folds in it
- Light can be transferred to stomach and duodenum for examining and exploration

---

I- The bile juice:-

- It is secreted **by the liver** while the food passes through the duodenum.

- It convert fats into emulsifies fats (i.e. dividing large masses of fats into small globules to facilitate the enzymatic effect on fats which are insoluble in water.

II- Pancreatic juice:

It is secreted by **the pancreas**. On food in the duodenum
- It includes the following:-

1- **Sodium Bicarbonate**: - it neutralizes HCl and renders the medium alkaline (pH= 8).

2-Pancreatic amylase: - it catalyzes the hydrolysis of starch and glycogen Into (Disaccharide) maltose.

$$\text{Starch and glycogen + water} \xrightarrow[\textbf{Alkaline medium}]{\textbf{Pancreatic amylase}} \textbf{(malt sugar)}$$

3-Trypsinogen:-

It is inactive, when it reaches the duodenum it is activated to **trypsin** by co-enzyme **enterokinase** (secreted by the lining wall of the small intestine) where trypsin enzyme catalyzes the hydrolysis of protein into polypeptides

$$\text{Proteins} \xrightarrow[\textbf{Hydrolysis}]{\textbf{Trypsin}} \text{polypeptide}$$

4-Lipase:

It catalyzes the hydrolysis of the emulsified fats into fatty acids and glycerol.

$$\text{Emulsified fats} \xrightarrow[\textbf{Hydrolysis}]{\textbf{Lipase}} \text{fatty acids and glycerol}$$

Intestinal juice:

- **It is secreted by**: certain cells in the wall of the small intestine.
- **It contains**: several enzymes that complete the process of digestion (Peptidases, Disaccharides and enterokinase).

1- <u>Peptidases</u>: - A group of enzymes, each one of them is concerned with the hydrolysis of peptide linkage between certain kinds of amino acids in the polypeptide chains to give various amino acids.

$$\text{Polypeptides} \xrightarrow{\textbf{Peptidases}} \text{amino acids}$$

2- <u>Disaccharides enzymes:-</u>

- A group of enzymes concerned with the hydrolysis of disaccharides into monosaccharaides, they are 3 enzymes:

<u>a-: **Maltase enzyme**</u>

Maltose ⟶ Glucose + Glucose **(Malt sugar)**

<u>**b- Surcease enzyme**</u>

Sucrose ⟶ Glucose + Fructose **(Cane sugar)**

<u>**c- Lactase**</u>

Lactose ⟶ Glucose + Galactose **(Milk sugar)**

3- Enterokinase:

- **It is not** a digestive enzyme.
- It acts only as a co-enzyme to activate the inactive trypsinogen enzyme into an active trypsin enzyme.

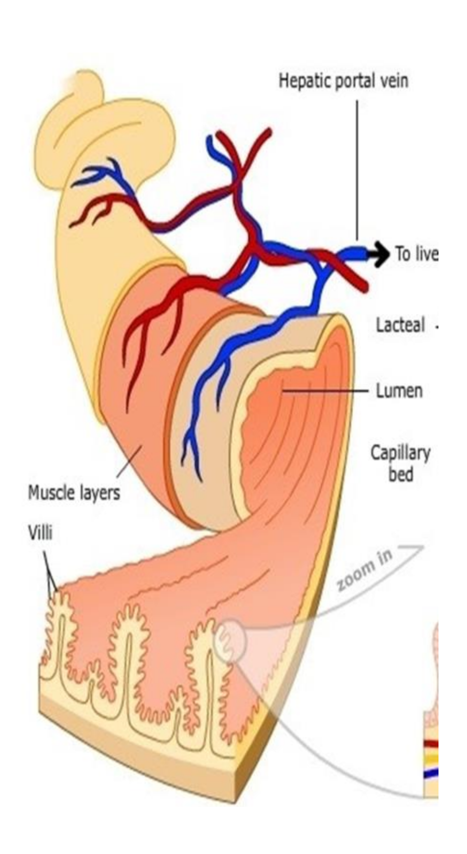
C Absorption

It is the transfer of digested food substances to the blood and lymph through the mucosa (epithelial lining) of the small intestine.

- It takes place by the inner epithelial lining of the ileum

- The inner epithelial lining of the ileum is folded to form villi.

- The villi increase the absorbing surface area of the inner lining wall of the ileum greatly to reach about 10 m2
I.e. about 5 times as much as the surface area of the human body surface.



1 Structure of the villus

- Each villus consists of:
1-**epithelial layer**
Enclose a lacteal (lymphatic) vessel,
The lacteal vessel is surrounded by
A network of both Venous and arterial blood
Capillaries.

Epithelium
Capillary network
Lacteal
Nerve

2-(Micro-villi)
- There are tiny microscopic projections cells
Of the villi, they are called (Micro-villi) and
They increase the area of the absorbing surface of villi.

2 Mechanism of absorption digested food

- The products of digestion are transferred through the villi by: Membrane **diffusion** and **active transport**.
- These absorbed substances pass through two routes: Blood route and lymphatic route

1-blood route

- **It starts with** the blood capillaries inside the villi .
- **The absorbed substances:**
Water, mineral salts, monosaccharaides, amino acids and vitamins which dissolve in water.
- These substances are carried to **the hepatic portal vein** to **the liver** and then to **the hepatic vein** then to **the inferior vena cava** then to **the right atrium** of the heart.

2-lymphatic route

- **It starts with** the lacteal vessels inside the villi.

- **The absorbed substances:**
  Fatty acids, glycerol and vitamins dissolved in it (A, D, E and K), some fats.

The fats are: resulted from the recombination of some fatty acids with glycerol, and some emulsified fats (tiny droplets) (which are not digested by lipase enzyme and absorbed directly by being engulfed **(Engulfment)** by the epithelial cells).

- These substances are carried to **the lymphatic system** which carries them slowly to **the superior vena cava** then to **the right atrium** of the heart.

D Metabolism

***It is the process by which the body can utilize the absorbed food.* It takes place by two opposite ways which are anabolism and catabolism.**

- **Catabolism:**

It is the process of producing energy required for the activity of the body from the absorbed food substances. Especially the glucose.

- **Anabolism:**

It is the process of using simple molecules for building more complex substances throughout a chain of chemical reactions that consume energy.

Examples of anabolism:-

- Glucose can be changed into glycogen and stored in the liver and muscles

- . - Amino acids can be changed into different forms of polypeptides and proteins to build up new tissues.

- Fatty acids and glycerol are converted into fats stored in the body under the skin.

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6 The large intestine

The undigested food passes from the small intestine to the large intestine. The epithelial wall of the large intestine has many convolutions to help in the absorption.

Functions of the large intestine:

1- Absorption of water and salts.
2- Secretes mucus that facilitates passage of faeces to outside.
3-make Wastes become semi-solid, and have bad odour due to the presence of certain types of bacteria in the large intestine.

Defecation: Wastes are expelled as faeces by means of: Strong muscular contractions of the rectum accompanied by the relaxation of two muscles of the anal sphincter situated on both sides of the anus.

Work sheet (1)

1-Mechanism of the enzyme action and buccal digestion the digestion process of food aims to its change into substances which can be…………

(A) Absorbed (b) defecated.

(c) Excreted. (d) Swallowed

2- The first compound resulted from the digestion of carbohydrates in human is……..

(a) Glucose. (b) Maltose.

(c) Lactose. (d) Sucrose.

3-On eating a piece of bread, which of the following enzymes will start its action first?

(a) Trypsin. (b) Peptidase.

(c)Amylase. (d) Lipase.

4- In which part of the human alimentary canal does the enzyme work efficiently, if the optimum pH for this enzyme =7.5?

(a)Mouth. (b) Small intestine.

(c) Stomach. (d)Large intestine.

5- The backflow of the gastric acid to the oesophagus is known as "Gastro-Oesophageal reflux" and it is occurred due to a defect in the muscle located Between the ………………

(a) Stomach and small intestine.

(b) Oesophagus and stomach.

(c) Ileum and large intestine.

(d) Duodenum and ileum.

6-The action of salivary amylase enzyme is stopped in the stomach, due to…………..

(a) The decrease in the enzyme amount.

(b) Changing all carbohydrates into maltose sugar.

(c)the difference in pH

(d) The difference in temperature.

7- Which of the following its digestion may be affected, if the liver is severely Damaged?

(a) Carbohydrates. (b)Fats.

(c)Proteins. (d) Disaccharides.

The digestive enzymes are completely absent from the…………juice.

(a) Pancreatic (b) bile

(c) Gastric (d) intestinal

8- The digestion of oil that is used in preparing meals starts in the

(a) Mouth. (b) Oesophagus.

(C) Stomach (d) small intestine

9- Which of the following food substances its digestion starts and ends in The small intestine?

(a) Rice. (b)Peanut butter.

(c)A piece of meat. (d) Cheese.

10- Bile juice plays an important role in accelerating the activity of………….. enzyme.

(a) Trypsin (b) amylase

(c) Maltase (d) lipase

11- The digestion of each of fats, proteins and carbohydrates together is affected by the occurrence of an injury in the ……

(A) pancreas. (b) Liver.

(c) Large intestine (d) stomach.

12- All the following enzymes digest the same type of food substances, except

(a) Lactase. (b) Sucrase.

(c) Lipase (d) maltase.

13- All the following enzymes complete the action of other enzymes or juices by breaking down their products into simpler molecules, except…………

(a) Maltase. (b) Peptidases.

(c) Enterokinase. (d) Lipase.

14- Which of the following enzymes doesn't produce simpler and symmetrical molecules through its action?

(a)Lactase. (b) Pancreatic amylase.

(c) Maltase. (d) Ptyalin

1-What happens in case of: the absence of enzymes from the digestive system?

2- What happens in case of: increasing the temperature of the medium where
The enzyme is present?

3- Explain: some enzymes work in two opposite directions.

4- What happens in case of: placing a piece of bread in the mouth and chewing it for three minutes?

5 -Give reason for: food passes easily in the digestive canal.

Work sheet (2)

1- Glycogen is hydrolyzed completely by the action of ………….enzymes.

(a) Amylase and sucrase

(b) Amylase and lipase

(c) Amylase and maltase

(d) Amylase and lactase

2-Which of the following doesn't contain digestive enzymes for carbohydrates?

(a) Pancreatic juice.
(b) Saliva.

(c)Intestinal juice.
(d)Gastric juice.

3- Protein is completely digested in…………..

(A) Stomach and duodenum.

(b) Mouth and stomach.

(c) Duodenum and ileum.

(d) Oesophagus and stomach.

4- Which of the following contains glands that secrete mucus not enzymes?

(a) Stomach.
(b) Pancreas.

(c)Small intestine.
(d)Oesophagus.

5-- Which of the following food elements aren't affected by the action of the digestive enzymes?

(a) Fats and vitamins.

(b) Proteins and minerals.

(c)Minerals and vitamins.

(d) Fats and proteins.

6- Which of the following has a role in the digestion process without secreting digestive enzymes?

(a)Liver.
(b) Pancreas.

(c) Stomach.
(d) Small intestine.

7-Which of the following food substances take a different way in its absorption?

(a) Butter.
(b)Egg white.

(c) Bread
(d) Honey.

8- Salmonella bacteria infect human, when eating contaminated food or water causing some Symptoms as diarrhea. Which part of the alimentary canal is most affected?

(a) Intestine.
(b)Oesophagus.

(c)Pharynx.
(d)Mouth.

9- If the lacteal vessels are blocked inside the villi, which of the following nutrients will not enter in the blood circulation with a normal rate?

(a) Fructose. (b) Fats.

(c) Glucose. (d) Amino acids.

10-Which of the following substances its /their absorption route differs after its /their digestion in the digestive system...

(a) Sugar. (b)Fats.

(c) Starch. (D) Proteins.

11- The process by which the absorbed food becomes a part of the body is called………………

(a) Absorption. (b) Digestion.

(c) Catabolism. (d) Anabolism

1-**What happens in case of: the removal of epiglottis from the pharynx?**

2-Give reason for: human doesn't suffer from ulcers in the oesophagus, when eating dry foods.

3-Explain: hydrochloric acid plays an important role in the digestion process in stomach.

4-What happens if: a person took a high dosage of antacid drug?

5- What happens if: the gastric juice contains sodium bicarbonate?

Transport in living organisms

A Transport in plants

All living organisms need transport:

- **In primitive plants like algae**:

The raw materials (carbon dioxide, water and mineral salts) and the products of photosynthesis move from one cell to another by diffusion and active transport.

- **In higher plants:-**

Gases move by diffusion while water, mineral salts and soluble products of photosynthesis need special systems for transport which are:-

1-Xylem tissue

It translocate water and mineral salts that are absorbed from the soil through the root to the stem then the root

2-Phloem

It translocate the high-energy organic food substance from the leaves to the different tissue of plant (root, stem, fruit and seed)

The main organ in higher plant which responsible for transportation is the **stem**

B Structure of the stem

It consist of a group of tissues:-

1. **Epidermis**

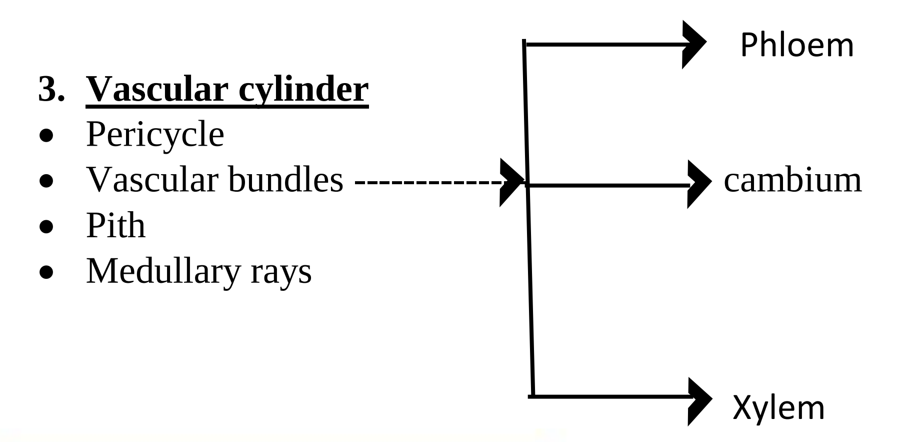
- (parenchyma cells)

2. **Cortex**

- Collenchyma cells
- Parenchyma cells
- Starch sheath

3. Vascular cylinder

- Pericycle
- Vascular bundles ------------
- Pith
- Medullary rays



Dicot Stem

Epidermal hair
Cuticle
Epidermis
Hypodermis
Cortex
Collenchyma
Chlorenchyma
Parenchyma
Bundle cap
Pericycle
Phloem
Cambium
Metaxylem
Protoxylem
Endodermis
Primary medullary ray
Pith

Transverse Section (T.S.)

1 **Epidermis:**

- It is one raw of adjacent, barrel-shaped, parenchyma cell. - The outer walls are covered by a cuticle, to prevent water loss.

2 **Cortex:**

1- It consists of:-

A-collenchyma cells:

They are several rows, their corners are thickened by cellulose. And may contain chloroplast

Functions:

1- Help as a mechanical support for the stem.

2-that they take part in photosynthesis.

B-parenchyma cells:

Several rows have intercellular spaces.

Function:

Help in aeration of the stem.

C- The starch-sheath:

It is the innermost row of cells of the cortex

Function:

It is used for storage of starch grains.

3 **Vascular cylinder:-**

- It occupies a large space of the stem and consists of the following tissues:

(A) Pericycle:

- It consists of alternative groups of parenchyma cells and fibres where each fiber group is in opposite to a vascular bundle.

Function:

It supports the stem and gives it elasticity.

(B) Vascular bundles:

- They are arranged in a cylinder, each bundle is triangular in shape with its base directed outwards.
- The bundle consists of the following tissues:

I. Phloem:

- It is the outer tissue of the bundle
-it consists of sieve tubes, companion cells and phloem parenchyma.

1-Sieve tubes:

- Sieve tubes appear in the longitudinal section as elongated cells arranged end to end. They contain cytoplasm without a nucleus.
- The sieve tubes are separated from each other by cross walls (sieveplates) which are perforated by tiny pores, through which cytoplasmic strands extend from one tube to another

2-Companion cells:

Each sieve tube has a nucleated companion cell. Vital functions of the sieve tube are organized by ribosomes and mitochondria present in the companion cell.

3-Phloem parenchyma:

Parenchyma cells join sieve tubes and companion cells together.

Function: -
Transport of organic food substances from the leaves to all the plant parts

II. cambium

It consist of one row or more of meristem tic cells that are found between the phloem and xylem

Function

Its cells divide to give a secondary phloem externally and secondary xylem internally

III. 2-Xylem:

- It is the internal part of the bundle
- It consists of xylem vessels and Tracheids

The vessel is formed of a chain of elongated cylindrical cells that are connected end to end.

- stages of its formation,

(a) the transverse walls of these cells have completely dissolved,

(b) At the same time, the cellulosic walls have thickened with lignin which is impermeable for water and solutes.

(c) The protoplasmic contents of cells died leaving a hollow tube.

- Many pits are scattered all over the wall, where the primary wall is left without thickening. Pits allow water topass from the inside of the vessel outwards.
- At the lining of the xylem vessels, strands of lignin taking various forms (sometimes spiral-shaped or annular) are seen.
- They support the xylem vessel and prevent the collapse of its wall.

Structure:-

a) **Tracheids:**

- They are similar to vessels except:

  They appear in the T.S as. Pentagonal or hexagonal vessels

  Appear circular in the T.S)

- They have pointed sharp and closed ends which are pitted. (Vessels are opened with notransverse walls.

b) **xylem parenchyma**

They are rows of parenchyma cells that are present between the xylem vessels

c) **Pith :-**

-Parenchyma cells occupying the centre of the stem

Function:-

Storage

d) **Medullary rays**

Parenchyma cells extending between the vascular bundles

Function:-

Join the cortex with pith

C Mechanism of transport in higher plants

It include two different process which are

1- Transport of water and salts from the root to the leaf

2- The transport of manufactured food from the leaves to all plant parts

1 Transport of water and salts from the root to the leaf

- **X**ylem is responsible for the translocation of water and salts from the root to the leaves by forces acting on the ascent of this sap

Forces responsible for ascent of sap in the plant:-

1- Root pressure theory
2- Imbibition theory
3- Capillary theory
4- Transpiration pull-Cohesion – adhesion theory

(1)Root pressure theory:-

- It is the force that acts to raise water vertically through xylem vessels for a short distance to a certain level.

Occurrence of root pressure:

1- It is due to the presence of continuous and direct absorption of water from the soil by osmotic pressure.

2- The exudation of water from the stump (cut stem), when a plant stem is cut very near to the soil.

- Defects of the theory :-
- **The root pressure theory cannot explain the ascent of water to high levels in tall trees (G.R): because:**
  1- The maximum root pressure does not exceed 2 atmospheres.
  2- Pinus and other conifers have no root pressure.
  3-The force of root pressure is affected quickly by external factors.

(2) Imbibition theory:-

- The walls of xylem vessels consist of cellulose and lignin that have a colloidal nature which has the ability to imbibe water

- This phenomenon explains the transport of water along the cell walls until it reaches the wall of xylem vessels and trachides of

the root and from it to the plant

Defects of the theory:-

Experiments had proved that the imbibition phenomenon has a very limited effect on the ascent of sap because the sap ascent through the cavities of xylem vessels and not along their walls only

(C)Capillary theory:-

It is the rising of water in tiny tubes. Such as xylem vessels whose diameter ranging from 0.02mm to 0.5mm

Defects of the theory:-

Capillarity is a weak secondary force for the ascent of sap because the finest capillary tube does not allow the rise of water more than a height of 150cm

(D)Transpiration pull-Cohesion – adhesion theory

- The two scientist Dixon and joly proved that the water pulled by the leaf due to the consumption of water in the metabolic process transpiration and evaporation in the leaves
- The theory explained that the water column rises in the xylem vessels depending upon three forces :-

1-Cohesive force:

- It is due to the strong mutual attraction between water molecules inside the xylem vessels and tracheids.

- This force explains the existence of a continuous column of water.

- The tubes must be free of any gasses or air bubbles to avoid the break of water column

2-Adhesive force

It is the force between water molecules and the walls of xylem vessels.

- It helps the water column to be held against the effect of gravity.

3-Transpiration pull:

This pull attracts the water column upwards due to the continuous process of transpiration in the leaves.

Dixon and Joly put three conditions required to pull water from xylem to leaves:-

1- The vessel must be like capillary tube.
2- The walls of the tube must possess an adhesive force to attract water.
3- The tubes must be free of any gas or air bubbles to avoid any breaking and therefore descent of the water column.

Note:-

When some seedlings are transplanted from a nursery to an open soil, they fall to grow, if they remain exposed to the sun for a long time before they are transplanted in the new soil.

Because heat of the sun causes a loss of water from the seedlings, air bubbles enter the xylem vessels and the water column is cut, so that water does not ascend in xylem vessels and the seedlings die.

- **The path of the sap during its ascent from the root to the leaves:-**

1- **Transpiration** lessens the water concentration in the air chamber above the stoma in the leaf.

2- **Evaporation** increases from the cells of the mesophyll surrounding the Stomata chamber.

3- **Water content** of the cells of mesophyll **decreases**, therefore their concentration increases.

4- The increasing in cell concentration creates a **pulling force** to attract water from the surrounding cells.

5- This will continue as far as the xylem elements in the venules and veins, then finally from the midrib of the leaf.

6- Transpiration pull **attracts water from xylem vessels and tracheids** of the stem and the root and also it will help in the lateral pull of water from the root hairs.

2 Transport of manufactured food from the leaf to other parts of the plant:-

Thain and Canny Scientists:

-They could see long cytoplasmic threads which contain organic substances inside the phloem tubes, these lines extend through tiny pores from one tube to another.

-They explain the transportation in the phloem on the basis of cytoplasmic streaming. (Cytoplasmic circular movement inside the sieve tubes.)

Explanation of cytoplasmic streaming:

It is an active process which needs more of ATP molecules which exist in the companion cells, **so that:**

- It is affected by temperature and oxygen in cells

-It is **delayed** with the decrease of temperature or oxygen in cells which delayed the movement of cytoplasm in sieve tubes.

Work sheet (1)

1- Chlamydomonas alga shares Spirogyra alga in that each of them..........

(A) Contains specialized transport tissues.

(b) Transfers gases to it from the surrounding medium by diffusion.

(C) Transfers the digested food substances through it by active transport.

(d) Transfers gases and digested food substances through it by diffusion and active transport.

2-On staining a transverse section of a dicot plant stem with iodine solution, which of the following appears with dark blue colour?

(a) Companion cells of phloem.

(b) Xylem vessels.

(c) The innermost row of cells in cortex.

(d) Cambium.

3-Each of the xylem tissue and the phloem tissue performs the transport process in plant, which of the following statements represents the best description for this process?

(a) Xylem transports water upward, while phloem transports food downward.

(b) Xylem transports water and salts upward, while phloem transports the ready-made sap downward.

(c) Xylem transports water and salts, while phloem transports the ready-made sap.

(d)Xylem transports the ready-made sap upward, while phloem transports water and salts downward.

4- Which of the following statements doesn't agree with the cells forming the outer layer of each of the plant stem and leaf?

(a) One row of parenchyma cells.

(b)Adjacent barrel-shaped cells.

(c) Coated cells with a layer that is impermeable to water.

(d) Barrel-shaped cells that have a storage function.

5- Which of the following participate(s) mainly in the transport of water in the plants stems?

(a) Vascular bundles.

(b) Xylem tissue.

(c)Tracheids only.

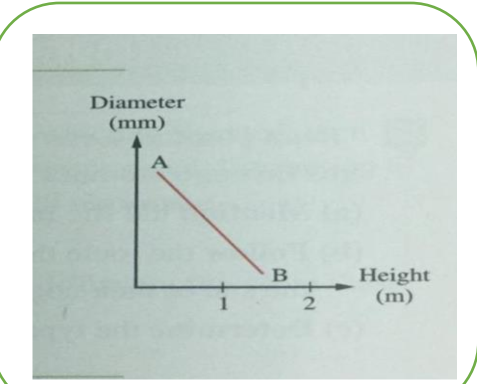
(d)Vessels only.

1-What happens in case of: the absence of meristematic cells from the stem? Of a new dicot plant?

2-Explain: the root cells obtain their food, although they don't contain chlorophyll and not exposed to light.

3- Explain: although xylem vessels and tracheids are non-living tissues, they contain nuclei.

4- The opposite graph illustrates the relationship between the Water height in xylem vessels and the diameter of these Vessels using a physical property:
(a) Explain the curve (AB).
(b) Why is the curve stopped at (B)?
(c) What do you expect to happen if the diameter of The vessels was more than 1 cm?



Work sheet (2)

1-Which of the following describes the structure of the stem in a dicot plant?
(a)It contains a ring-shaped vascular bundle.
(b) It contains central vascular cells.
(c)It contains several layers of xylem that are surrounded by a ring of phloem.
(d) It contains vascular bundles that are scattered through the pith tissue.
2- Which of the following determines the rate of water movement from the roots to the leaves?
(a) Water absorption through the root hairs' cells.
(b) The low pressure of water fullness in leaves.
(c)Water diffusion through stomata.
(d)Water evaporation from the mesophyll tissue cells.
3-Which of the following substances have the ability to absorb water, but they are insoluble in it?
(a) Cellulose and cutin.
(b) Pectin and suberin.
(c)Pectin and lignin.

(d) Cellulose and subrin.

4- Which of the following factors helps in accomplishing the cultivation of a plant in a pot after keeping it in a glass of water for two days?
(a) Leaving the plant exposed to the Sun for a longer period of time.
(b) Planting its roots in a moist soil.
(c) Planting its roots directly in a dry soil.
(d) Covering the vegetative system with a bag before its planting.
5-Which of the following statements doesn't agree with the nature of lignin?
(a) It is a substance with a colloidal nature that has the ability to imbibe water.
(b) It may take many shapes, such as spiral and annular inside the xylem vessel.
(c)It is a supportive substance that strengthen the xylem vessel and prevents its collapse.
(d)It is a permeable substance to water and solutes.

1-Give reason for: the nature of xylem plays a role in the ascent of water inside the xylem vessels.

2- Bean plant absorbs water and mineral salts by roots, and obtains Carbon dioxide gas through stomata ". In the light of this:
(a) Mention the site in which carbon dioxide gas diffuses.
(b) Follow the route that is passed by water, salts and carbon dioxide, till reaching the site of their consumption in the plant.
(c) Determine the type of compounds that are formed as the final products.

3-"The mechanism of transporting organic materials in phloem has been explained on the basis of cytoplasmic streaming". How far this statement is correct? With explanation

4-What is the relation between: companion cells and cytoplasmic streaming movement?

5- What is the relation between: obtaining oxygen and transport process in the plant?

6- Explain: the transport process in plant is affected by external factors.

7- Give reason for: the slow movement of cytoplasm and its streaming in the sieve tubes may occur.

Human transport system

- In small animal:-

Both respiratory gases and food are transported by diffusion

- In bigger and more complicated animal:-

There must be a specialized transport system in this animals

- Transport in human body takes place through two systems:

(a) Blood vascular system (Circulatory system)
(b) Lymphatic system.

i. Circulatory system

- It consists of the heart and the blood vessels through which the blood passes.

- The blood vessels form a complete circuit, so that the circulatory system is closed.

A Heart

- It is a hollow muscular organ which lies nearly in the middle of the chest cavity. (Slightly toward the left)

- It is surrounded by the **pericardium** to protect the heart and facilitate its pumping action

1 Structure

- It is divided into 4 chambers which can be divided:-
Transversely:-

Atria	Ventricles
The upper two thin- walled muscular chamber which receive the blood	The lower two thick – walled muscular chamber that pump the blood

Longitudinally by muscular wall:-

The right side	The left side:
Consists of right atrium and right ventricle	Consists of left atrium and left ventricle
Tricuspid valve connects exists.	Bicuspid valve exists (or mitral valve)
filled with a deoxygenated blood	Filled with oxygenated blood.

- Valves of the heart:-

1- Right tricuspid valve

It lies between the right atrium and
Right ventricle

2- Left tricuspid valve

It lies between left atrium and
Left ventricle

3- Semi –lunar valves

Aortic valve and pulmonary valve
Present at the connection of heart with both the aorta and pulmonary artery

Function:-

They allow the blood to pass from two ventricles to inside the arteries in one direction

2 Heart beats

-The rhythmic heart beats are spontaneous as they originate from the cardiac tissue itself.

- It has been proved that the heart continues beating regularly even after it has been disconnected from the body and cardiac nerves

3 Origin of heart beat

The regular heart beat is related to the presence of Sino-atrial node which is:-
It is a specialized bundle of thin cardiac muscular fibers buried in the right atrial wall near the connection between the right atrium and the large veins.
- It is considered as pace maker for the heart beats.

- It beats at a regular rate of 70 beats/minutes (it pumps 5 liters of blood every minute, this quantity nearly equal to the whole quantity of blood of the body)

- This rate changes according to the physical and psychological state of the body this is because the Sino-atrial node is connected to two nerves:

1-The parasympathetic nerve: acts to lower the rate of cardiac beats e.g. during sleep and grief.

2- The sympathetic nerve: acts to increase the rate of heart beats e.g. in case of severe physical effort and joy also it gradually increases after waking up.

5 Mechanism of heart beats:-

1-The Sino-atrial node sends impulses spontaneously to Stimulate the muscles of the two atria to contract.

2-The electrical impulse reaches the atrio-ventricular node (At the site of connection of atria with ventricle).

3-The impulse transfers rapidly from the atrio-ventricular node Through His fibers then spreads from the inter-ventricular septum to the wall of both ventricles through Purkinje fibers to stimulate them to contract.

Heart beats:
* We can distinguish two different sounds in the heart beat:
(1) Long and low pitched (lubb): It is due to closure of the two valves between the atria and ventricles during ventricular contraction.

(2) Short and high-pitched (dupp):
It is due to closure of aortic and pulmonary valves during ventricular relaxation

----

B Blood vessels

The blood vessels in the human body include

i. **Arteries**
ii. **veins**
iii. **capillaries**

1 Arteries

- They are vessels that carry blood from the heart to all body parts and usually found buried among the body muscle
- All arteries carry oxygenated blood except pulmonary artery

- Artery wall is built up of three layers as follows :-

(A)Outer layer: it consist of a connective tissue

(B)Middle layer: it is relatively thick and consist of involuntary muscle which contract and relax under the control of nerve fibers

(C)Inner layer: it consist of one row of thin epithelial cell that is topped with elastic fibers which help the artery to be able to push the blood

2 Veins

- They are vessels that carry the blood from all body parts to the heart
- They carry deoxygenated blood except the pulmonary vein
- The vein wall is composed of same layers of artery but

-the elastic fibers are rare

-The middle layer is less thick so the vein are thinner and it doesn't pulsate

-there are valves in some veins that prevent the backflow of blood such as the limb veins that are near to the skin

Note:-

- The arm veins can be observed when the arm is tied tightly with a bandage above the elbow, this is done by **William Harvey**, English doctor, who discovered **the blood circulation** in the 17th century after **Ibn Elnafees** has discovered it in the **10th century**.

3 Capillaries

Definition:

They are tiny, microscopic vessels which connect the arterioles with the venules.

Diameter:

Average diameter of (7:10) microns.

Walls:

Very thin and consist of one row of thin epithelial cells with tiny pores between them.

Length:

About 80 .000 Km. (If the capillaries of the human body were put end to end).

Functional suitability:
- They spread in the spaces between cells all over the body tissues so that they reach all the cells of the body and supply them with all their requirements.

- The wall is about 0.1 micron thick so that it facilitates a quick exchange of substances between the blood and tissue cells.

They were discovered: by the Italian scientist **Malpighi** (at the end of the 17th century), he completed the work of **Harvey**.

	Arteries	**Veins**
Blood direction	from the heart to other organs of the body	to the heart
Blood type	Oxygenated blood, except the pulmonary artery which comes out from the right ventricle to the lung.	deoxygenated blood, except the pulmonary veins which opens into the left auricle
Location	Buried among the body muscles.	Beneath the skin.
Wall	Thick, elastic and pulsate.	Thinner, less elastic not pulsate.
Valves	Not found except at the base of aorta and pulmonary artery.	Number of veins possesses a system of internal valves which prevent the backflow of blood.

C Blood

- It is the principal medium in transport.

Structure:

It is a liquid connective tissue, contains

1- Red blood cells

2-white blood cells

3--the tissue fluid part of it is called plasma.

4-Platelets

Colour:

Reddish in colour.

The medium:

Weakly alkaline (pH=7.4).

The volume:

The human body contains from 5 to 6 litres of blood on average.

----

1 Erythrocytes RBCs (Red blood corpuscles):-

- **Origin:** bone marrow where 100 million of RBCs are produced every minute.

- **Number**: (4: 5 million/mm3) in males and (4: 4.5 million/mm3) in females.

- **Description**: circular and concave in both sides. **Color**: red due to the presence of hemoglobin.

- **Age**: not more than 120 days, each one circulates within the blood circulation for 172.000 times, then they are broken down in liver, spleen and bone marrow and their proteins are reused to form the bile juice which plays an important role in digestion of fats

- . **Structure:** have no nucleus (enucleated) but contain large amounts of hemoglobin.

- **Function :-**

1-**transporting oxygen from the two lung to all the body parts as follows**:-
(A)- Haemoglobin. Combines with O_2 in lungs to produce **Oxyhaemoglobin** substance of bright red colour (blood of arteries).

(B)RBCs then transfer oxygen to the body cells where Oxyhaemoglobin leaves oxygen for the cells and turns again to haemoglobin..

2-Transporting carbon dioxide from all body part to the two lungs as follows:-
Haemoglobin. Then combines with CO_2 to produce **Carboaminohaemoglobin** substance of dark red colour (blood of veins).

- RBCs return back to the lung Carboaminohaemoglobin leaves CO_2 and turns again to Hb and the cycle is repeated.

---

2 Leukocytes WBCs (White blood corpuscles):-

Origin:
Bone marrow, the spleen and the lymphatic system.
Number:
(7000/ mm^3), the number increases during inflammation (diseases).
Description:
Have no definite shape.
Colour
Colourless.

Age:
(13-20 days)
Function:
Have many types, each type has a special function, their main function is to Protect the body against infection, where they:

1- Attacking microbes (destroy and engulf them).

2- Removing of foreign substances in the blood (such as the products of microbes).

3- Removing of dead cells and other wastes.

4- Production of antibodies:
----

3 -Plasma:-

It is 54% of blood volume.
It consists of:-
- Water (90 %)
- Inorganic salts (1 %), such as Na+, Cl-, (HCO)- , Ca++
- Proteins (7%), such as albumin, globulin and fibrinogen.
- Other components, such as digestive products, hormones, enzymes, antibodies and wastes (urea).

4 Blood Platelets:-

- **Origin**: Bone marrow.
- **Number**: (250 000/ mm3).
- **Description:** small non-cellular particles.
- **Age**: About 10 days, they are regenerated continuously.
- **Size**: 1/4 the size of RBC.
- **Function**: Plays an important role in clotting.

D Blood clot

It occur When a blood vessel is cut, blood soon forms a clot.
Importance: to prevent bleeding before it leads to a shock followed by death.

1 Factors (Reasons) of blood clot:

1- Blood exposure to air.

2-Blood friction with a rough surface such as damaged vessels and cells.

2 Mechanism of blood clotting:-

When the factors of blood clotting exist, a sequence of steps takes place:

1- Both the blood platelets and the damaged cells (at the site of wound) form a protein substance called **thromboplastin**.

2- In presence of Ca++ and blood clotting factors in the plasma, thromboplastin activates the conversion of **prothrombin** to the enzyme **thrombin**.

> **Prothrombin**: *is a protein formed in the liver with the help of vitamin K and it is passed directly into the blood.*

3- Thrombin catalyzes the conversion of **fibrinogen** (soluble protein in plasma) into **fibrin** (an insoluble protein).

4-Fibrin precipitates as a network of microscopic interlacing fibers. The blood aggregates and forms a clot which blocks the whole in the damaged blood vessel. In this way bleeding stops.

3 Reasons for the non-clotting of blood inside the blood vessels

1- It runs in a normal fashion in the blood vessels without slowing down.

2- The platelets slide easily and smoothly inside the blood vessels in order not to be broken.

3- The liver secretes **heparin** substance which prevents the conversion of prothrombin to thrombin.

E Functions of the blood:-

1- Transport of digested food substances, O_2, CO_2, wastes, hormones and some active and inactive enzymes.

2- Controlling processes of metabolism and keeping the body temperature at 37ºC. In addition to the regulation of the internal environment (homeostasis) such as osmotic potential, pH value …etc.

3- Protection of the body against microbes and pathogens through immunity involving lymphatic system.

Protection of the blood itself against bleeding by formation of clots.

F Blood pressure

Blood is a viscous liquid that circulates_because of the process of heart beats but:
-it passes smoothly within the arteries and veins.

- It doesn’t pass smoothly within the microscopic blood capillaries due to their resistance to the viscous blood.

- So it need a pressure which is called (blood pressure)

- **Blood pressure increases :-**

When the ventricles contract the blood pressure increases and the blood pressure is maximum in the arteries nearer to the heart.

- Blood pressure decreases:-

  When the ventricles Relax: the blood pressure decreases and becomes minimum as we go away from the nearer arteries to the heart to reach its minimum ratio in blood capillaries and veins (10 mm Hg).

- The return of blood in veins to the heart **depends on the valves** in it and the muscles surrounding them

1 Measurement of blood pressure

- The blood pressure is measured by means of mercuric instruments, **sphygmomanometers**.

- Its reading consists of two numbers:

- **The maximum number**: is measured during contraction of ventricles (systolic). (The maximum blood pressure in the normal man is 120 mmHg.)

- **The minimum number**: is measured during relaxation of ventricles (diastolic), **(**The minimum blood pressure in the normal man is 80 mmHg.)

Example:

The blood pressure of the normal man is 120/80 mm Hg. 120: indicates the blood pressure during contraction of ventricles (systolic). 80: indicates the blood pressure during relaxation of ventricles (diastolic)

1 Method of measurement of the blood pressure:-

- The values of blood pressure can be measured by listening to the heart beats and as well as between one beat and another, as follow:
1- On hearing the sound of heartbeat, the doctor can determine the maximum value of blood pressure, referring to the ventricles contraction (systolic)

2-. When the sound disappears, the doctor can determine the minimum value of blood pressure, referring to the Ventricles relaxation (diastolic)

Notes:-
1- There are some digital instruments to measure the blood pressure, but they are not accurate as mercury instruments.

2-The blood pressure increases gradually by aging and it must be under medical control to avoid its harmful effects

Work sheet (1)

1-Which of the following statements doesn't apply to the valves?
(a)They are present at the connection of the heart with the pulmonary and aortic arteries
(b) They are present at the connection of the heart with the superior and inferior venae Cavae
(c) They allow the passage of blood from the atrium to its opposite ventricle.
(d)They allow the passage of blood from the two ventricles to inside the arteries in one direction

2-Which of the following blood vessels contains the lowest percentage of carbon dioxide and the highest percentage of oxygen?
(a) Superior vena cava. (b)Pulmonary vein.
(c)Inferior vena cava. (d) Pulmonary artery.

3-Which of the following characteristics allows the artery to adapt with the change in the blood pressure during the passage of blood through it?

(1) Thinning of the inner layer wall.

(2) Presence of elastic fibers.

(3) The thickening of the muscular layer wall.

(a)(1). (2) & (3). (b)(1)& (2) only.

(c)(1) & (3) only. (d)(2)& (3) only.

4- Which of the following doesn't agree with the characteristics of the pulmonary vein?

(a) It carries oxygenated blood.

(b)It has a wider lumen than that of the pulmonary artery.

(c)The thickness of its wall is thinner than that of the pulmonary artery's wall.

(d)It carries deoxygenated blood.

5-which of the following groups represents the blood vessels carrying oxygenated blood?

(a)Aorta- Pulmonary artery - Renal artery.

(b)Venae Cavae - Pulmonary artery -Renal vein.

(c)Venae Cavae - Pulmonary vein -Renal vein.

(d) Aorta - Pulmonary vein - Renal artery

1-"The human heart contains valves with specific fixed function". How far this statement is correct? With explanation.

2-What happens in case of: the absence of valves from the heart muscle?
O What happens in case of: the absence of sino-atrial node?

3-What is the relation between: the heart valves and heartbeats?

4-What is the similarity between: root hairs and blood capillaries?

5-What t happens in case of: decreasing the level of haemoglobin that is present in the red blood corpuscles than the normal range?

Work sheet (2)

1- In which of the following places haemoglobin is expected to change into Oxyhaemoglobin?

(a) Two kidneys. (b)Heart.

(c) Two lungs. (d)Liver.

2- Which of the following don't have an immunization role in the human body

(a) White blood corpuscles. (b)Red blood corpuscles.

(c) Blood plasma. (d)Blood platelets.

3-The patient with liver fibrosis is exposed to……………..

(a) Decrease in vitamin (K).

(B) The blood liquidity (haemophilia).

(c) Increase in the formation of thrombin substance.

(d) Increase the percentage of blood proteins.

4- To know the saturation degree of oxygen accurately for a patient who suffers from severe pneumonia blood gases test was done, where the blood sample should be taken from……………….

(a) The artery and mixing with heparin substance.

(b) The vein and mixing with heparin substance.

(c) The artery and mixing with a substance that helps in coagulation.

(d) The vein and mixing with a substance that helps in coagulation.

5-"The liver helps in the formation of blood clot", "the liver prevents the occurrence of blood clot"

(a) The first statement is correct and the second statement is wrong.

(b) The first statement is wrong and the second statement is correct.

(c) The two statements are correct.

(d) The two statements are wrong.

1-What happens in case of: the shortage of iron element in the human food?

2-What is the relation between: the blood clotting and vitamin (K)?

3- What is the relation between: liver and the formation of blood clot?

4- Explain: the human blood pressure decreases in case of the occurrence of bleeding

Blood circulation

Blood circulation in Man is divided into three main pathways:

1. **Pulmonary circulation**
2. **Systematic circulation**
3. **Hepatic Portal circulation**

A Pulmonary circulation

It starts from the right ventricle and ends at the left atrium.

1- **The right ventricle** contracts, **the tricuspid valve** closes the opening of the right atrium.

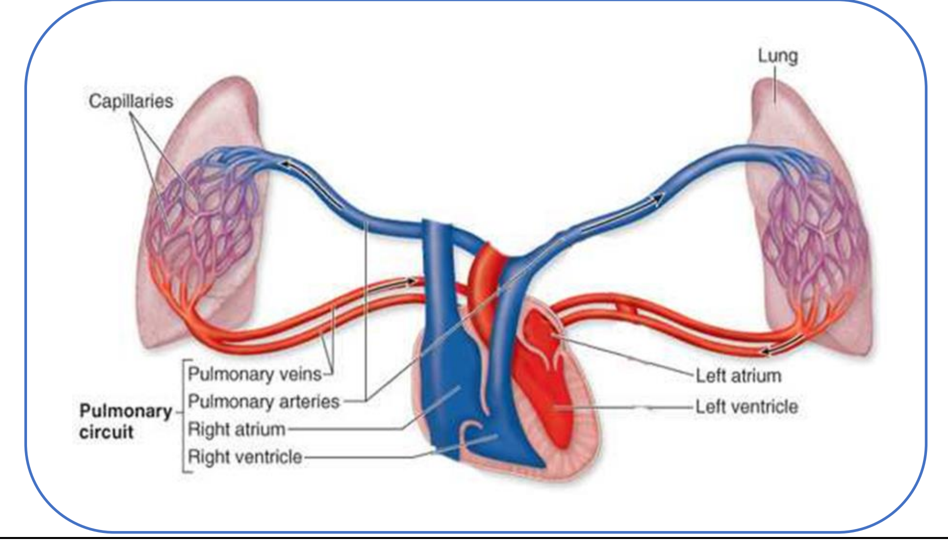
2- The deoxygenated blood will rush through **the pulmonary artery** through **the semi-lunar valve** which prevents the back flow of the blood to the right ventricle.

3- The pulmonary artery gives rise to two branches, each branch goes to **a lung** where it branches to form several arterioles which **terminate in blood capillaries which spread around the alveoli.**

4- **Gas exchange takes place** where CO2 and H2O vapour diffuse from the blood while O2 will move toward it, the blood becomes **oxygenated**.

5- The oxygenated blood returns from the lungs through **four pulmonary veins** (two veins from each lung) to open into the left atrium.

6-When the left atrium contracts, blood passes to the left ventricle **through the bicuspid valve**. Prevent the backflow of blood to the left atrium



B Systematic circulation

It starts from the left ventricle and ends at the right atrium.
1- When **the left ventricle** contracts, **the mitral valve** (bicuspid valve) closes.

2- The oxygenated blood will rush from the left ventricle to **the aorta** while **the semi-lunar valve** prevents the back flow of the blood to the left ventricle.

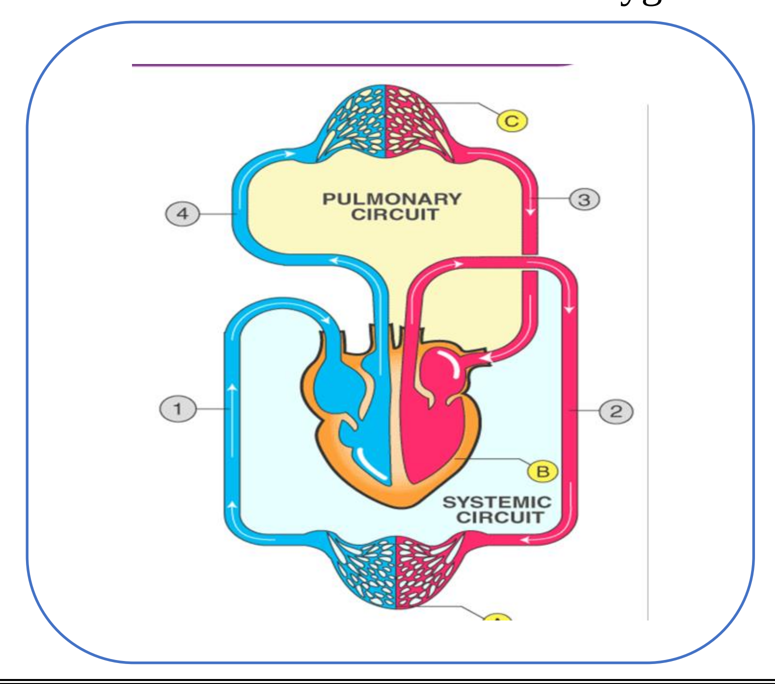
3- **The aorta** gives rise to several arteries, some of which move upwards and others go downward.

4- Arteries then branch to form smaller and smaller arterioles which end by blood capillaries, these capillaries spread through the tissues in between the cells.

5- O2, water and dissolved food substances are transported to the cells, on the other hand, products of catabolism, such as CO2, diffuses to the blood in the capillaries, the colour of the blood changes from light red to dark red. **It becomes deoxygenated.**

6- Blood capillaries collect to give rise to larger and larger blood vessels and finally veins, which power their deoxygenated blood into the superior and inferior vena cava which carry blood to the right atrium.

7- The walls of the right atrium contract and so the blood is forced to the right ventricle which becomes filled with deoxygenated blood



N.B.: Contraction of the right side of the heart occurs at the same time as contraction of the left side, therefore, pumping of the deoxygenated blood from the right ventricle and pumping of the oxygenated blood from the left ventricle, both take place at the same time.

C Hepatic Portal circulation:

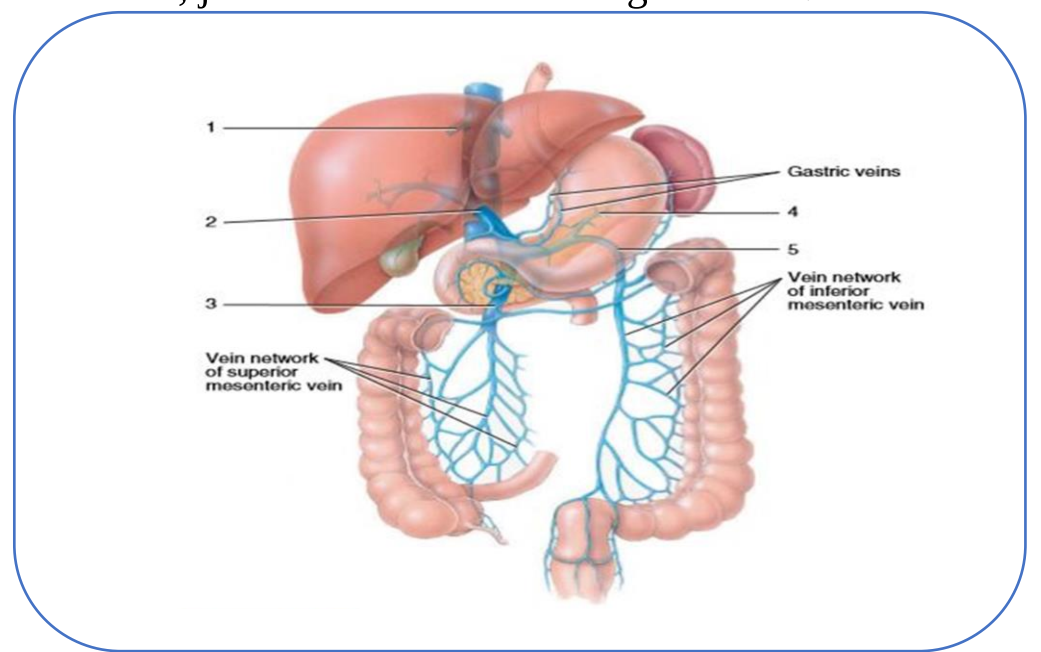
After absorption of digested food substances, both glucose and amino acids are transported to the blood capillaries inside the villi.

1- The blood capillaries aggregate into small veins, then large veins and finally they pour their content into the hepatic portal vein, which receives veins from the pancreas, the spleen and the stomach.

2- The hepatic portal vein carries blood into the liver where it branches to end with minute blood capillaries.

3- Excess food substances which exceed the body needs filter through the capillary walls and pass through the liver where they undergo certain changes.

4- The blood capillaries unite into the hepatic vein which leaves the liver to pour its contents into the upper part of the inferior vena cava, just before it enters the right atrium.



D The lymphatic system

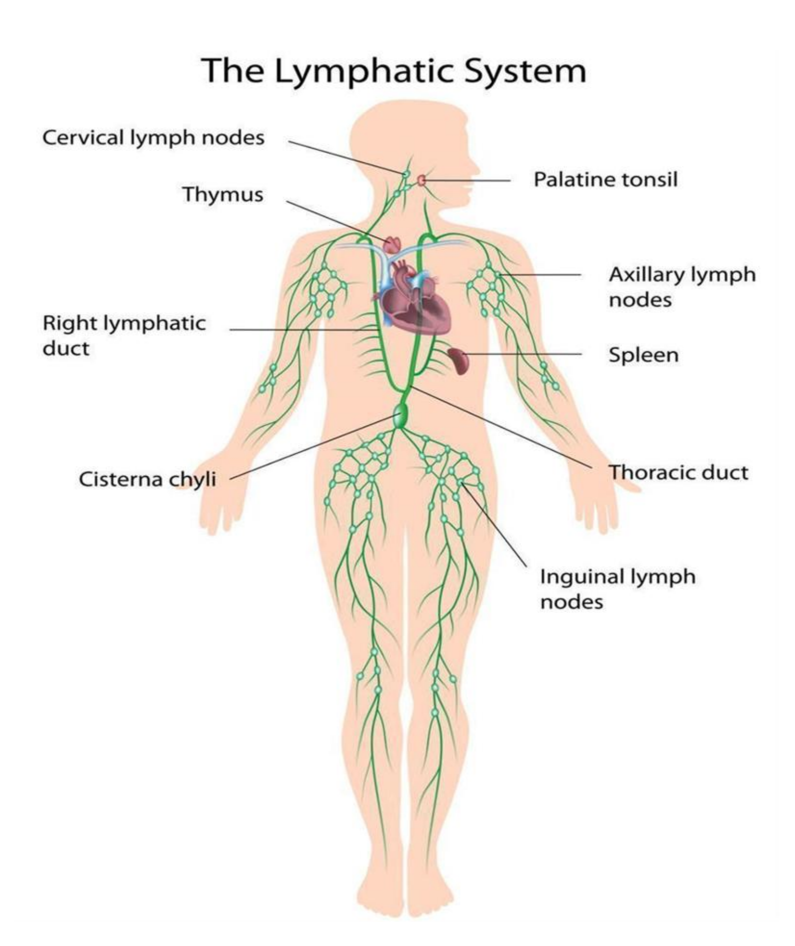
- The lymphatic system is considered as the immune system of the body
due to its ability for defence and the production of the antibodies that give the body its immunity.
- The spleen is considered one of the most important lymphatic organs in the body.

- The lymphatic system consists of:

1- **The lymph:** A fluid diffuses from plasma, it consists of all components of plasma, in addition to a large number of leucocytes (WBCs).

2- **Lymphatic vessels:** They collect the lymph and empty it into the circulatory system along the superior vena cava.

3- **The lymph nodes:** The lymph passes across the lymph nodes which are found at certain points along the lymph capillaries.
They trap microbes by white blood cells which they produce.



Work sheet (1)

1- The blood that reaches the brain cells leaves the heart from the

(a) Right atrium.

(b) Right ventricle.

(c) Left atrium.

(d) Left ventricle.

2 -Which of the following valves allows the passage of blood under high pressure?

(a) Aortic valve.

(b) Mitral valve.

(c) Bicuspid valve.

(d) Tricuspid valve.

3- Which of the following happens when the two ventricles contract?

(a)The pressure of aorta increases.

(b)The atrio-ventricular valves are opened.

(c)The semi-lunar valves are closed.

(d) The pressure decreases in these ventricles.

4-Which of the following disagrees with the contraction of the two ventricles?

(a) The passage of blood through the aortic valve.

(b) The closure of the mitral valve.

(c) The closure of the tricuspid valve.

(d) The closure of the pulmonary valve.

5- The number of the major blood vessels that carry oxygenated blood and come out from the heart is

(A) 2 (b) 3

(C) 4 (d) 1

6-Which of the following statements is correct?

(a) The right ventricle is filled with blood before the left ventricle.

(b) The left ventricle is filled with blood before the right ventricle.

(c) Left atrium is filled before the right atrium.

(d) Two ventricles are filled with blood at the same time.

7-Which of the following happens at the ventricles relaxation?

(a) Opening of semi-lunar valves.

(b)Opening of atrio-ventricular valves.

(c)Pressure of aorta becomes higher than that of the two ventricles.

(d) Pressure of left atrium becomes higher than that of right atrium.

8-How many times does the blood pass through the heart during its passage from the two kidneys till reaching the aorta?

(a) More than four times.
(B) Four times.
(c)One time.
(D) Two times.

1-Explain: the blood pressure is different in each of the aorta and pulmonary artery, although both of them are arteries.

2 -Compare between: the bicuspid valve and tricuspid valve.

3 -Explain: liver is called the gate of food in the body.

4 -Follow by arrows only: the pathway of a red blood cell that is present in the blood accompanied by the absorption of the digested food, till reaching the right atrium of the heart.

Work sheet (2)

1-On the arrival of blood to the heart through the venae cavae, through which of the following blood vessels will the blood pass after that?

(a) Pulmonary artery.
(b) Pulmonary vein.
(c) Hepatic portal vein.
(d)Hepatic vein.

2-The highest value of blood pressure is in the…………

(a) Superior vena cava.
(b) Pulmonary artery.
(c) Inferior vena cava.
(D) Aorta.

3-Which of the following occur when the blood passes from the right ventricle to the two lungs?

(a) The closure of mitral valve and the opening of tricuspid valve.
(b) The opening of mitral valve and the closure of tricuspid valve.
(c)The opening of semi-lunar valve and the closure of tricuspid valve.
(d)The closure of semi-lunar valve and the opening of tricuspid valve.

4-Which component of the lymph fluid can be contributed in the formation of the blood clot?

(a)Calcium ions (Cat) (b) Sodium ions (Na).

(c)Vitamin (D). (d) Vitamin (A).

5-The heart chambers can be arranged from the thinner to the thicker as Follows ……..

(a) Left ventricle /right ventricle / two atria.

(b) Right ventricle / left ventricle / two atria.

(c) Two atria / left ventricle / right ventricle.

(d) Two atria /right ventricle/ left ventricle.

6- Which of the following is considered the first receiver for the nicotine for a smoker?

(a)Left ventricle. (b) Right atrium.

(c) Right ventricle. (d)Left atrium.

7-The blood vessel where the blood passes under low pressure and contains high level of CO_2 is………..

(a) Renal artery.

(b) Vena cava.

(c) Pulmonary artery.

(d) Aorta

1- Stud the following figure, then answer:

(a)Mention the number of the blood vessel that:

1- Connected with the blood vessels of pancreas. Head and arms spleen and stomach.

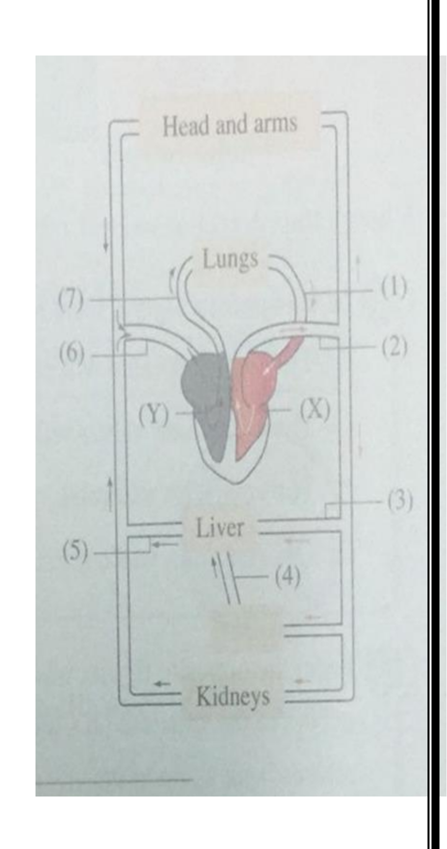
2-Carries the highest level of oxyhaemoglobin.

3- Contains the highest level of amino acids after Eating a meal.

(b) Which of them (X) or () contains the bicuspid Valve?

(c) What is the side of heart that contains oxygenated Blood (X) or (Y)?

(d)Mention the type of blood in the two blood vessels of Kidneys no. (2) and (7)?



2-What happens in case of the absence of lymphatic nodes that are present along the lymphatic vessels?

3- Explain: spleen has a great importance for the circulatory and lymphatic systems

Respiration in living organisms

-Cellular respiration -

Before studying cellular respiration we must differentiate between gas exchange and cellular respiration

Gas exchange	Cellular respiration
It is the process by which the living organism **obtains oxygen**, directly in case of unicellular or by a respiratory system in case of multicellular, and **releases CO_2** as a final product of respiration	It is the process by which energy is extracted from bonds in the food molecules manufactured by the plant, or eaten by the animal. - This energy is stored in the form of ATP molecules to be used in different activities.

A Cellular respiration:-

- Carbohydrate molecules especially glucose are considered as energy-storing foods, and also they carry energy from one cell to another.
- Cellular respiration start by oxidation of glucose molecule
- The glucose molecule is used to study the steps of breakdown of food molecules because it is the most commonly used by the majority of living organisms.
- Most stages of glucose molecule oxidation occur inside mitochondria
- The energy released from cellular respiration is stored in ATP molecules

B Structure of ATP

ATP (Adenosine Tri Phosphate) molecule is built up of three sub-units:

1- **Nitrogenous base**: Adenine which has base properties.

2- a5-**Carbon pentose sugar**: Ribose sugar.

3- Three **Phosphate groups**.

ATP is considered as the universal currency of energy in the cell Because any energy required by the cell needs ATP and when ATP is converted into ADP, by losing one phosphate group, energy is released
(About 7: 12 Kcal/mole).

ATP ➡ ADP+ Energy (about 7-12 K Cal/mole)

There are two types of cellular respiration:
a) Aerobic cellular respiration.
b) Anaerobic cellular respiration

C Aerobic cellular respiration

These reactions take place: in presence of oxygen.

- They take place in three steps:-

1-Glycolysis occur in the cytosol (non- organelle part of cytoplasm)

2-Krebs cycle occur inside the mitochondria

3-electron transport chain occur inside mitochondria

- But before starting we should know very important notes

A-The majority of these reactions occur inside the mitochondria bec it contain:-

1- respiratory enzymes
2- co-enzymes
3- water
4- phosphates
5- Other molecules such as cytochromes

B-During the reactions of glycolysis and Krebs cycle:

Hydrogen atoms are removed from the carbon skeleton of the glucose molecule (oxidation) to pass to the co-enzymes which act as **hydrogen-carriers**.

- Of these co-enzymes are:

NAD+ (Nicotinamide adenine dinucleotide) and FAD (Flavin adenine dinucleotide), each one of them receives 2 electrons and reduced into NADH and FADH2, respectively as follows: (Reduction)

$$NAD^+ + H_2 \longrightarrow NADH + H^+ \text{ (Reduction)}$$

$$FAD + H_2 \longrightarrow FADH_2$$

C- The produced energy is stored in ATP molecules.

- Number of produced ATP molecules from the oxidation of 1 mole of glucose: 38 molecules.

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + 38ATP$$

1 GLYCOLYSIS

- **It occurs in case of:**

Aerobic (presence of O2) and anaerobic (absence of O2) cellular respiration so that it is called **anaerobic respiration**.

- **Site of reactions:**

In the cytosol of the cell.

- **Steps:**

1- Glucose molecule is converted into Glucose 6-phosphate (6 C) then Fructose 6-phosphate (6 C) then Fructose 1,6 -diphosphate (6 C).

2- The Fructose 1,6 –diphosphate is broken down into 2 molecules of PGAL (phosphoglyceraldehyde) (3C)

3- Each molecule of PGAL is oxidized into a molecule of pyruvic acid (3 C).

- **During these reactions:**

2 molecules of NAD+ are reduced to NADH $_2$ molecules of ATP are produced in cytosol.

- **The energy produced from glycolysis**

(2ATP): is not sufficient for performing the biological functions, so that the molecules of pyruvic acid pass from the cytoplasm to the mitochondria in presence of oxygen to produce greater amount of energy

- **General equation of glycolysis:**

$$C_6H_{12}O_6 \xrightarrow[\text{Respiratory enzymes}]{\text{Anaerobic respiration}} 2C_3H_4O_3 + 2ATP$$

- **Importance of glycolysis:**

1- Production of energy (2 ATP)

2- Production of 2 pyruvic acid molecules

The pyruvic acid molecules will be used in aerobic and anaerobic respiration

2 Krebs cycle:-

This cycle was first described by Sir **Hans Krebs in 1937**, for which he won the Nobel Prize in 1953.

- **Before Krebs cycle and In presence of oxygen:**

- Each pyruvic acid molecule, in the mitochondria, is oxidized into an acetyl group and each acetyl group then combines with a compound called co-enzyme A (Co-A) to give rise to acetyl coenzyme (A) (or acetyl Co-A).

- **Products of this reaction:**

- 2 NADH molecules.

- 2 CO_2 molecules.

- **Site of occurrence**

It occur inside the mitochondria

- **Reactions of Krebs cycle:**

1- The **Co-A** of each **acetyl Co-A** molecule **splits off to** repeat its role while **the acetyl group** (2C) combines with a 4-carbon compound (**oxaloacetic acid**) to form a 6-C compound (**citric acid**).

2- In the pathway of the cycle, citric acid molecule passes by **three intermediate compounds**, starting with **ketoglutaric acid (5C)** then **succinic acid** (4C) and ending with **malic acid (4C)**.

3- The reactions of Krebs cycle **end with citric acid once more**, so that the cycle is known as the citric acid cycle

4- Each cycle **consumes one acetyl group**, so that the cycle takes place **two times for the oxidation of the glucose molecule**.

- **Products of one Krebs cycle**

1- 3 molecules of NADH.

2- 1 molecule of $FADH_2$.

3- 1 molecule of ATP.

4-2 molecules of CO_2.

- NOTE

Krebs cycle does not need oxygen

, since all electrons and protons which are removed during oxidation of carbon atoms are received by NAD+ and FAD.

---

3 Electron transport

- **Site of reactions**: mitochondria.
- **Steps of electron transport:**

After glycolysis and Krebs cycle, most of the energy is transferred to the hydrogen carriers (NAD+ and FAD) in the form of high energy level electrons.

1- These electrons and hydrogen descend step by step through energy levels of cytochromes molecules (electron carriers).

2-Cytochromes: Co-enzymes; located in the inner wall of mitochondria and carry high-energy electrons at different energy levels.

3- The energy liberated during this passage of electrons is used in the **oxidative phosphorylation** process to form ATP molecules from ADP and phosphate groups.

4- Finally, the 2 electrons combine with 2 protons (H+) and an oxygen atom to form water according to the equation:

$$2H^+ + 2e^- + 1/2\ O_2 \longrightarrow H_2O$$

- **Role of oxygen in electron transport reactions:**
  Oxygen is considered as the last acceptor of electrons in electron transport series.

During the electron transport reactions, molecules of NADH and FADH2 are **oxidized** where:-

1- Oxidation of NADH gives 3 molecules of ATP.

2- Oxidation of FADH2 gives 2 molecules of ATP.

- **Importance of electron transport series reactions:**
  Releasing the energy stored in NADH and FADH2 through the passage of electrons over a sequence of cytochromes and using the produced energy to form ATP from ADP and phosphate.

- **Calculating the number of ATP molecules**
  -In aerobic respiration the oxidation of one molecule of glucose produce 38 ATP molecule where
- 2 molecule in the cytoplasm of the cell
  (Produce during glycolysis)

- 36, molecule in the mitochondria (during the respiration stages)

D Anaerobic cellular respiration (Fermentation)

It is the process in which the living organism gains energy in the absence, or in low quantities, of oxygen and by the help of some enzymes.

- **Steps of fermentation:**

1- It begins with glycolysis, where:
2 molecules of pyruvic acid,
2 molecules of NADH
2 molecules of ATP are produced,

- **The 2 molecules of pyruvic acid are transformed into:**

1- ethyl alcohol and CO_2
2-lactic acid according to the type of the cell.

- **Types of fermentation**:-

1- acidic fermentation
2- alcoholic fermentation

---

1 Acidic fermentation

As in animal cells (especially the muscle cells) and bacteria where:-

- **In the muscle cell**: when the muscle exert effort .they resort to the anaerobic respiration where they consume most of the oxygen that is present in them and tend to reduce the pyruvic acid into lactic acid ($C_3H_6O_3$) through its combination with NADH causing (muscular fatigue)

- **In bacteria cell**: Many of **dairy industry** depend on this process (such as cheese, butter and yogurt).

$$\underset{\text{(Glucose)}}{C_6H_{12}O_6} \longrightarrow \underset{\text{(Lactic acid)}}{2\,C_3H_6O_3} + 2ATP\ \text{(energy)}$$

- **When oxygen is present in these cells**, lactic acid is then **oxidized again into pyruvic acid**, then acetyl co-A and **no muscle fatigue is present**.

2 Alcoholic fermentation:

- **Site**: in yeast and some plant tissues.

- **Steps:** The pyruvic acid is reduced into ethyl alcohol and CO_2 is evolved.

- **Importance:** It is used in bread and alcohol industries.

$$C_6H_{12}O_6 \longrightarrow 2\ C_2H_5OH + 2CO_2 + 2ATP\ (energy)$$

(Glucose) (Ethanol)

- **Experiment to prove alcoholic fermentation:-**

Steps :-

1- Put a sugary solution (or molasses diluted with double of its volume with water) in a conical flask then add a piece of yeast and mix it thoroughly
2- Close the flask with a stopper of rubber through which a delivery tube passes
3- Dip the free end of the tube into a beaker containing lime water
4- Leave the apparatus in a warm place for several hours

Observation:-

1- Gas bubbles are seen on the surface of solution in the flask
2- Lime water has become turbid

Conclusion:-

Turbidity of lime water is a proof that co2 gas has been evolved as a result of anaerobic respiration

Work sheet (1)

1- ATP molecules represent the energy currency in the cell, because they………

(a) Are the smallest molecules of energy in the cell?

(b) Store the least amount of energy in the cell.

(C) Transfer the energy easily to perform the function of the cell.

(d) Can save their energy for a long period.

2- The structure of ATP molecule is different from the structure of ADP molecule in the

(a) Type of nitrogenous base.

(b) Type of sugar.

(c) Number of carbon atoms.

(d) Number of phosphate groups.

4 The actual splitting during glucose oxidation is occurred to…………. Molecule.

(a) Phosphoglyceraldehyde

(b) Glucose

(c) Glucose 6-phosphate

(D) Fructose 1,6-diphosphate

4- Which of the following processes is considered the source of energy in all the living organisms?

(a) Formation of ATP molecules in the plant cells.

(b) Photosynthesis in the green plants.

(c) Formation of ATP molecules in the animal cells.

(d) Formation of ATP molecules in the plant and animal cells.

5-The amount of energy that 1s produced directly from glycolysis in the cytosol is stored in…………….. Molecule

(a) ATP (b) NADH

(c)FAD (d) each of ATP and FAD

6- What is the number of NADH compounds that are resulted from two cycles of citric acid?

(a) 3 (b) 6

(c) 18 (d) 12

7-During the glycolysis of 4 molecules of glucose, -....ATP molecules will be Produced.

(a) 16 (b) 8

(c) 4 (d) 12

1 Give reason for: on illustrating the mechanism of cellular respiration, food is not expressed by a molecule of fructose.

2 What is the difference between: ATP and ADP?

3 Explain: the cellular respiration is different from the burning process.

4 Give reason for: ATP molecules are considered a temporary store for energy inside the cell

5 "The structure of ATP molecules helps them in performing their function" How far this statement is correct? With explanation.

Work sheet (2)

1- The fatty acids enter in the cellular respiration in the form of -…….molecule.

(a) (4C) (b) (3C)

(c)(2C) (d) (1C)

2-The amount of ATP that is resulted directly from the complete oxidation of 2 glucose molecules during Krebs cycle inside the mitochondria is……………………

(a) 76 (b) 38

(c) 72 (d) 4

3-The oxidation of one glucose molecule in the presence of oxygen during the aerobic respiration process produces ………..Of ATP in the cytoplasm of the cell.

(A) One molecule

(b) Two molecules

(c) 36 molecules

(D) 38 molecules

4-ATP molecules are produced in all the following, except……….

(a) Glycolysis.

(b) Krebs cycle.

(c) Dark reactions in stroma.

(d) Light reactions in grana.

5-The complete oxidation of two glucose molecules requires the occurrence of Krebs cycle ………….

(A) four times. (B) three times.

(c) Twice. (d) Once.

6- During aerobic cellular respiration process, the plant produces energy in

(a) Cytosole only.

(b) Mitochondria only.

(c) No correct answer.

(D) Mitochondria and cytosole.

7- In case of the absence or lack of oxygen, NADH compound that is resulted from the glycolysis donates its electrons to the…………….

(A) Lactic acid. (b) Pyruvic acid.

(c) Citric acid. (D) Cytochromes.

8-The number of ATP molecules that are resulted from the oxidation of one glucose molecule in the absence of cytochromes from mitochondria is

(a) 4 (b) 38

(c) 62 (d) Zero.

1- Give reason for: glycolysis occurs in the aerobic and anaerobic respiration.

2-"The cell may use protein as a source to produce energy". How far this statement is correct? With explanation.

3-what happens in case of: the absence of coenzyme (A) from the cells of a living organism?)

4-Explain: the shortage of oxygen doesn't affect the life of some living organisms.

5- Write the number that indicates: the number of lactic acid molecules that are resulted from one molecule of glucose in the anaerobic respiration.

Respiration in living organisms

Human body contain a system that extract oxygen from the air then transfer it to the blood which deliver it to the body cells this system is called ‘’respiratory system ‘’

A Respiratory system in man

1 -Mouth or nose

- The air enters the body through the nose or the mouth.

- It is preferable for air to enter through the nose, because:

1- It is **warm**, as it is lined with numerous blood vessels.

2- It is **moist**, as it secretes mucus.

3- It also **serves as filter** as it contains hairs which act as a filter.

2 The pharynx

- Air the passes through the pharynx

- The pharynx is a common passageway for both air and food.

3 The larynx

- It enters the trachea through the larynx (which is also known as voice box).

4 The trachea

Functional suitability of trachea:

1- **Its wall contains a series of 3/4cartilage rings**, which maintain the trachea opens for air.

2- **It is lined with cilia which beat upwards**, to purify the air where it impedes the entry of small foreign bodies, and moves them to the pharynx, where they may be swallowed.

- The trachea is divided at its lower end into **two bronchi** which divide and subdivide into progressively smaller **bronchioles.**

- Each bronchiole finally opens into one of the many **alveoli** (air sacs).

5 The lungs

Composed of the alveoli, the bronchioles and the blood capillaries surrounding them.

Functional suitability of the alveoli

1- **Number of them is about 600 million per lung:**
To increase the surface area of respiration.

2- **Walls of them are considered as actual respiratory surface**, because:
They are thin to increase the speed of gas exchange.

3-They are surrounded by a large network of blood capillaries whose blood receives oxygen from the alveolar air and from the bronchioles surrounding them.

4- **They are moistened** by water vapour which is necessary for dissolving CO2 and O2 so that gas exchange between the air of alveoli and the surrounding blood in the blood capillaries occurs.

B Role of respiratory system in excretion

It serves to excrete CO_2 and also it has a role in the excretion of water with the expired air, as:

- Man usually loses daily about 500 cm**3** of water through the lungs out of the 2500 cm**3** of water he loses daily. This is due to the evaporation of the water that moistens the alveoli.

- This water which moist the alveoli is necessary for dissolving O2 and CO2 so that the exchange of gases between the air of the alveoli and the surrounding blood in the capillaries occurs.

C Respiration in plant

It is a process in which the plant obtain the chemical energy that is stored in the form of (glucose) through breaking down of the carbon bonds in the organic substance to carry out of its vital activates

The plant cells have two types of respiration:

1- Aerobic respiration

In which the release of en energy occurs by the oxidation process in the presence of oxygen

2- Anaerobic respiration

In which the release of energy occur in the absence of oxygen

---

1 Respiration in most plants

In most plants, each living cell is in direct contact with the environment and therefore gaseous exchange is easy, and O_2 diffuses internally while CO_2 diffuses externally.

2 Respiration in vascular plants

In vascular plants (complicated structure) O_2 reaches cells through various passageways:

(a) Stomata:
Where the air diffuses through the stomata to the air chambers, then to all the intercellular spaces in various parts of the plant. Oxygen then diffuses through the cell membranes and dissolves in the water of the cell.

(b) **Phloem:**
Where some of oxygen is carried to the phloem dissolved in water, then it reaches the tissues of the stem and root.

(c) Roots:
Oxygen enters the plant through the roots, soluble in water of the soil solution which is absorbed by root hairs or imbibed by cell wall.

d) **The stomata of green plant stem and the lenticels or any cracks in the bark of woody stem**
They act as an entrance for air

D Getting rid of carbon dioxide by plants:

(a) By direct diffusion:
By the plant cells which are directly exposed to the external environment where CO_2 diffuses to the air or the soil.

(b) Cells that lie deep in the plant:
CO_2 is passed to the xylem or phloem tissues, then these tissues will carry CO_2 in their turn to the stomata and finally to outside

E Relation between photosynthesis and respiration:-

- The plastids of green plants perform the photosynthesis process producing glucose and oxygen gas
- Glucose and oxygen gas move to the mitochondria to release the energy through the respiration process
- Carbon dioxide gas and water that are resulted from the respiration process move to the plastid to accomplish the photosynthesis process

1. Procedures

(1) Bring a green potted plant and place it on a glass plate and put a small beaker containing clear limewater next to it, then invert a glass bell jar over them, then cover the bell jar with a black piece of cloth, as in figure (A).

(2) Prepare a similar apparatus with a pot that is
The bell jar is covered by a black
Empty of any cultivated plant.
Piece of cloth, in order to keep the
(3) Put some clear limewater in another small
Light away from the green plant and
Stop the photosynthesis process
Beaker. Which consumes CO, that is
(4) Leave the two apparatuses and the beaker in
Present in the air of bell jar or that
Between them for some time, as in figure (B).

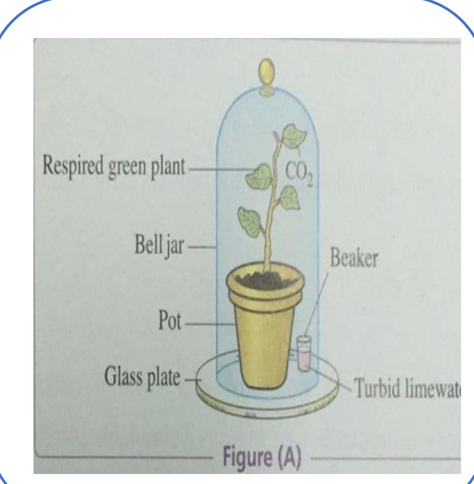


Figure (A)

2. Observation

Limewater becomes turbid in step no. (1) Only, and it doesn't become turbid in steps no. (2) and no. (3).

3. Conclusion:

The green plant performs respiration process and releases carbon dioxide gas, as a result of this process.

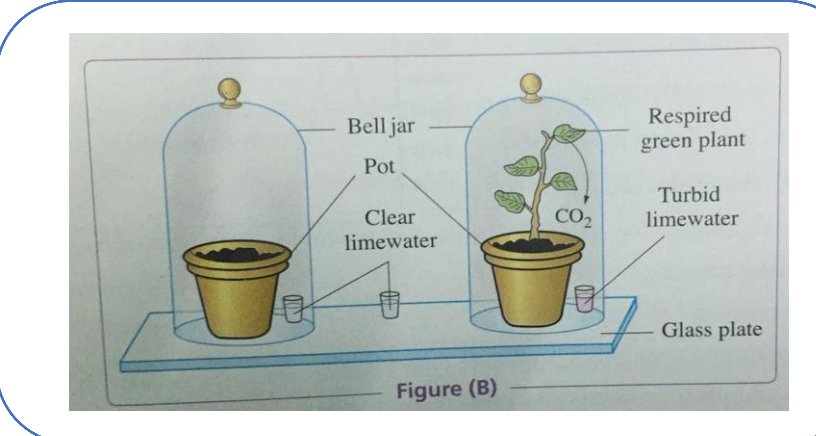
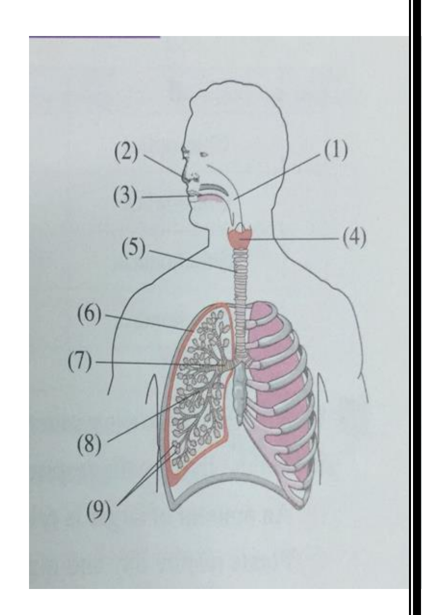


Figure (B)

Work sheet (1)

1- In the opposite figure:



(1) The air that enters into the two lungs is moistened in ..

(a) Part no. (2) Only.
(b) Part no. (3) only.)
(c) Part no. (4) Only.
(d) Parts no. (1) and (2).

(2) The mucus is present in…………………..

(a) Part no. (1) Only.
(b) Part no. (2) Only.
(c) Part no. (7) Only.
(d) Parts no. (2) and (7).

(3) The part that represents the voice box is no. …………….

(a)(7). (b)(3).
(c)(5) .(d)(4).

(4) Which of the following structures doesn't consist of cartilages?

(a) (8). (b)(5).
(c)(7) .(d)(6).

(5) Which of the following structures is/are rich in blood capillaries?

(a)Part no. (9) Only.
(b)Part no. (2) Only.
(c) Parts no. (2) and (8).
(d) Parts no. (2) and (9).

2-The cilia that are present in the trachea work on pushing the mucus with the minute

Foreign particles towards the…………………

(a) Two lungs. (b) Nose.
(c) Pharynx .(d) Epiglottis.

3-The respiratory tracts perform all the following, except

(a) Moistening the air.
(b) Filtering the air.
(c) Exchanging gases.
(d) Warming the air.

1-What happens in case of: putting a growing plant in a glass box that is covered by

2-What happens in case of: uncovering the bell jar with a piece of Black cloth in

3-What happens in case of: the nose is devoid of hairs and mucus?

Work sheet (2)

1-Which of the following doesn't/don't affect the rate and the depth of respiration?

(a)Physical exercises.

(b) Ratio of each of Oxygen and carbon dioxide in the atmospheric air.

(c) Respiratory enzymes.

(d)Psychological state

2-Which of the following statements doesn't agree with the reason for the speed of the blood transport to oxygen that is present in the two lungs?

(a) Air that enters the two lungs contains a greater amount of Oxygen comes out of them.

(b) The alveoli are surrounded by a huge network of blood

(c)The wall of alveolus is thin and its surface area is large.

(d)The Oxygen concentration in blood is less than its concentration 1

3-All the following increase the rate of respiration spontaneously, except………….

(a) Increasing the pH value in blood.

(b) Increasing the carbon dioxide level in blood.

(c) Increasing the blood acidity.

(d) Decreasing the haemoglobin level in the red blood corpuscles.

4-All the following share in the arrival of oxygen gas to the cells of the herbaceous plant Stems, except ……………

(a) Phloem passageways. (b) Stomata.

(c) Lenticels .(D) Roots.

5-Photosynthetic phosphorylation and oxidative phosphorylation,

(a) Are reversible processes.

(B) The first occurs in the mitochondria and the second occurs in the chloroplasts.

(C) The first needs energy and the second releases energy.

(d) Are different in the source of energy.

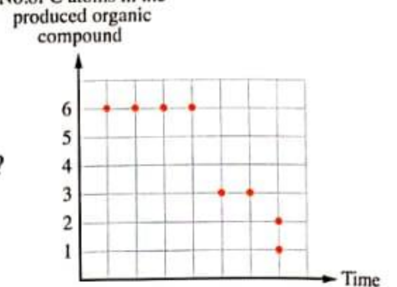
1-You know that bronchi contain cilia". Deduce the function of these cilia.

2-What happens if: the trachea is devoid of cartilaginous rings that are present in its wall?

3-Give reason for: the presence of millions of alveoli in one lung.

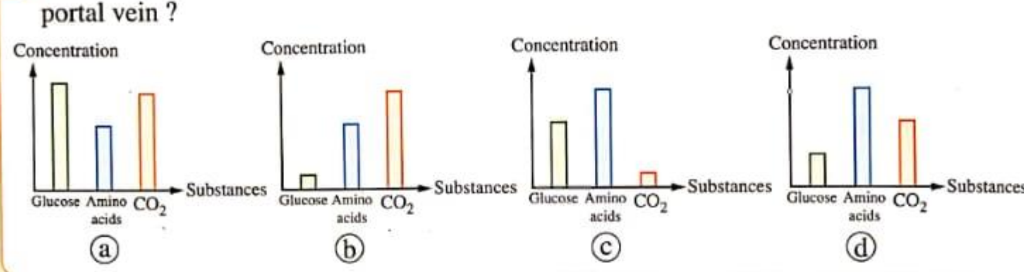
4- What happens in case of: increasing the thickness of alveoli walls?

14 * The opposite graph represents the organic compounds which are formed during cellular respiration inside the cell cytoplasm of a living organism in case of O_2 deficiency, which one of the following organisms performs this type of respiration ?



ⓐ *Paramecium*.
ⓑ Bacteria.
ⓒ *Euglena*.
ⓓ Yeast fungus.

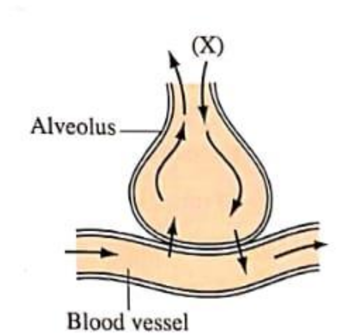
15 Which of the following graphs describes the substances concentration in the hepatic portal vein ?



16 Some soil fungi cause wilting diseases for some crops, whereas they attack the xylem vessels and grow inside them, which of the following vital processes will be affected by these fungi ?

ⓐ Cohesion force among H_2O molecules.
ⓑ Adhesion force between H_2O molecules and walls of xylem vessels.
ⓒ The flow rate of solutes during transmission.
ⓓ The absorption rate of H_2O through the root hairs.

17 From studying the opposite figure, what is the substance that is formed from the combination of substance (X) with the haemoglobin in the red blood corpuscle in the two lungs ?



ⓐ Protein.
ⓑ Iron.
ⓒ Carbo-aminohaemoglobin.
ⓓ Oxyhaemoglobin.

(10) What is the organ which secretes digestive juices for all types of food ?

ⓐ Stomach. ⓑ Liver. ⓒ Pancreas. ⓓ Duodenum.

(11) What is(are) the substance(s) that form(s) the greatest portion of lymph ?

ⓐ Water. ⓑ Fats.
ⓒ Proteins. ⓓ Monosaccharides.

(12) What is the ratio between the amount of energy produced from ATP molecule and that produced from NADH molecule ?

ⓐ 1 : 3 ⓑ 2 : 1 ⓒ 1 : 2 ⓓ 3 : 1

(13) * Study the opposite graph which shows the route of (100 g) of a food substance (X) through different digestive organs after more than 1 hour of its ingestion. What is the form of (X) when it is transferred through the villi of small intestine ?

ⓐ Glycerol. ⓑ Monosaccharides.
ⓒ Fatty acids. ⓓ Amino acids.

(14) Potato slices with equal lengths were put in serial concentrations of sucrose sugar for 30 minutes, their lengths were measured before and after treating, the following graph shows the ratio between the length before and after treating and the sugar solution concentration. Which of the following shows the change in the length of the potato slices and the pressure of fullness with water with increasing the concentration of sugar solution ?

	The change in length	Pressure of fullness with H_2O
ⓐ	Increases	Increases
ⓑ	Increases	Decreases
ⓒ	Decreases	Decreases
ⓓ	Decreases	Increases

Answer the following questions (22 : 27) :

22 **Explain :** the presence of root hairs in the bean plant, despite their continuous penetration in the soil.

23 **What** is the least number of each molecule of NADH and $FADH_2$ at which the number of ATP molecules resulted from them is equal ?

24 **Write what this statement indicates :** "An organ in the body through which oxygenated and deoxygenated blood enter inside it and the deoxygented blood comes out from it".

25 "Superior vena cava carries the completely digested substances".
How far the statement is correct ? With explanation.

26 The radioactive carbon has an important role in proving some vital processes inside the plant. **Give two different examples.**

5. A green potted plant was placed on a glass plate and a small beaker containing clear limewater was put next to it and each of them is under a glass bell-jar, and they were left for period of time exposed to light, we observe that ....

ⓐ limewater becomes turbid.

ⓑ limewater becomes turbid, then the turbidity disappears.

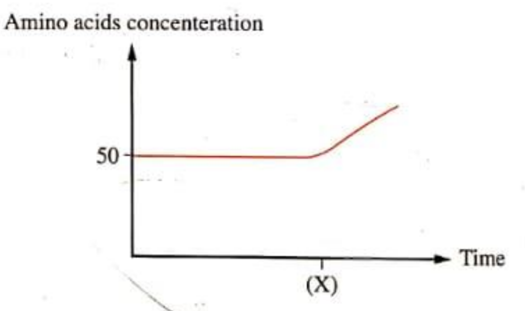
ⓒ limewater is clear.

ⓓ the colour of limewater changes into dark red.

6. A red blood corpuscle begins its journey from an artery in the left arm directed to the thumb cells for supplying them with oxygen, then it returns back to the left ventricle. What is the number of sites of the blood capillaries through which the red blood corpuscle passed during its journey ?

ⓐ 1 ⓑ 2 ⓒ 3 ⓓ 4

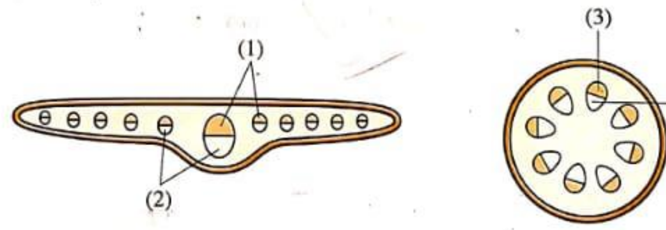
7. In the opposite graph, which of the following enzymes is responsible for changing the concentration of amino acids in the hepatic portal vein at point (X) ?



ⓐ Lipase. ⓑ Amylase.

ⓒ Peptidase. ⓓ Pepsin.

8. * In an experiment that illustrates the transport of water, the roots of a dicot plant were put in water coloured with a dye, after several hours, two sections were taken one from the stem and the other from the leaf of the plant. Which of the following parts would be coloured with the dye ?



ⓐ (1) and (3). ⓑ (2) and (4). ⓒ (2) and (3). ⓓ (1) and (4).

EXAM 1

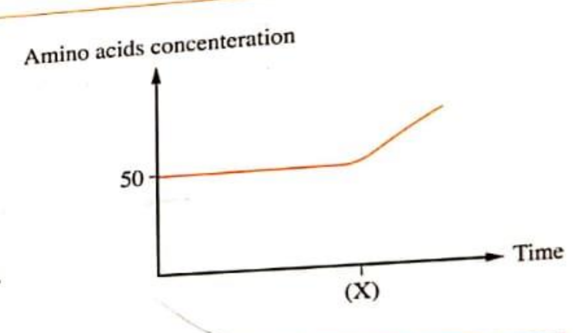
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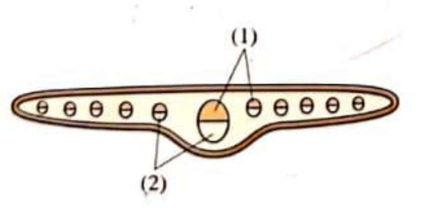
(a) 1 (b) 2 (c) 3 (d) 4

7. In the opposite graph, which of the following enzymes is responsible for changing the concentration of amino acids in the hepatic portal vein at point (X) ?



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(3)
(4)

(a) (1) and (3). (b) (2) and (4). (c) (2) and (3). (d) (1) and (4).

19 The opposite diagram shows some vital processes that occur inside some living organisms, in which of the following organisms do these processes take place ?

ⓐ *Chlorella* alga. ⓑ Yeast fungus.
ⓒ *Bilharzia* worms. ⓓ *Orobanche* plant.

Glucose
ATP
Energy

20 Which of the following plants do you expect its leaves epidermis is devoid of cutin ?

ⓐ Bean. ⓑ Corn. ⓒ *Elodea*. ⓓ Cactus.

21 Which of the following compounds its deficiency affects both the rate of respiration and photosynthesis processes in *Elodea* plant ?

ⓐ ATP ⓑ FAD ⓒ NAD^+ ⓓ NADP

Answer the following questions (22 : 27) :

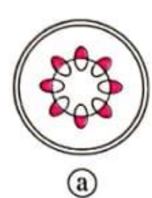
22 **From the opposite figure, deduce** what happens to the solution in tube (X).

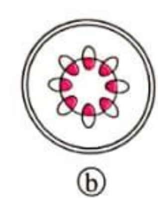
Limewater
Boiled seeds
(X)
(Y)

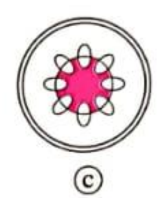
23 **Explain :** the transfer of water in plant is faster at noon and slower at night.

24 **What happens if :** the respiration of the root tissues stops ?

5 A plant was put in water containing red dye for 24 hours, then it was removed and several sections were taken from the plant stem, which of the following figures illustrates that ?

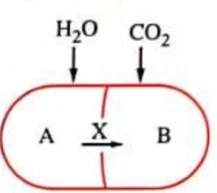

ⓐ


ⓑ


ⓒ


ⓓ

6 In the opposite figure, which of the following represents (X) ?



ⓐ ATP and PGAL
ⓑ ADP and CO_2
ⓒ H_2O and NADP
ⓓ $NADPH_2$ and ATP

7 Which of the following is found in the pulmonary artery with the highest percentage ?

ⓐ Oxyhaemoglobin.
ⓑ Carbo-aminohaemoglobin.
ⓒ Haemoglobin.
ⓓ Haemoglobin and oxyhaemoglobin.

8 ✻ In which of the following stages the least amount of ATP molecules is released directly ?

ⓐ Glycolysis.
ⓑ Oxidation of pyruvic acid into acetyl group.
ⓒ One Krebs cycle.
ⓓ Electron transport chain.

9 In the opposite figure, what does part (X) represent ?



ⓐ A main branch from the trachea.
ⓑ A branch from a blood vessel.
ⓒ An alveolus.
ⓓ A bronchiole.

General Exam 10

Choose the correct answer (1 : 21) :

1 In which of the following parts of the human digestive system does the process that is illustrated in the opposite diagram occur ?

Protein → X → Y → Z → L

ⓐ Stomach and duodenum.
ⓑ Mouth and stomach.
ⓒ Oesophagus and duodenum.
ⓓ Mouth, stomach and duodenum.

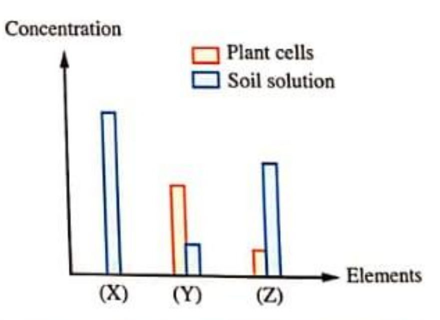
2 Which of the following produces the highest amount of energy ?

ⓐ The oxidation of phosphoglyceraldehyde aerobically.
ⓑ The oxidation of malic acid to oxaloacetic acid.
ⓒ The acidic fermentation to pyruvic acid.
ⓓ The alcoholic fermentation to pyruvic acid.

3 Which of the following can be used as a drug to prevent the formation of blood clots for some patients ?

ⓐ Fibrin.
ⓑ Fibrinogen.
ⓒ Heparin.
ⓓ Thrombin.

4 * The opposite graph illustrates the concentration of elements (X), (Y) & (Z) in the cells of a plant and in the soil solution, which of the following element(s) do the rates of respiration during its(their) absorption increase ?

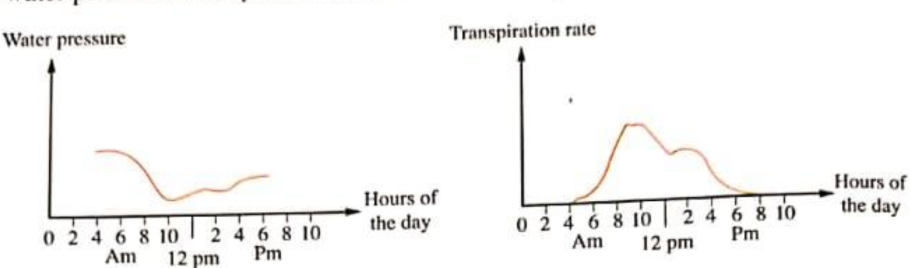


ⓐ (X).
ⓑ (Y).
ⓒ (Z).
ⓓ (X) and (Z).

5 Which of the following tissues is **not** present in the leaf of cotton plant ?

ⓐ Mesophyll tissue.
ⓑ Xylem.
ⓒ Phloem.
ⓓ Cambium.

5 The two following graphs illustrate the rate of the transpiration process and the water pressure in the plant leaf cells within the day hours :



What do you conclude from your study to the previous two graphs ?

(a) The water pressure decreases inside the leaf cells with increasing the transpiration process.

(b) The water pressure increases inside the leaf cells with increasing the transpiration rate.

(c) The stomata of the leaf closes at 10 am.

(d) The stomata of the leaf opens at 4 am.

6 What is the process that occurred in the chloroplast and is opposite to the process of the photosynthetic phosphorylation ?

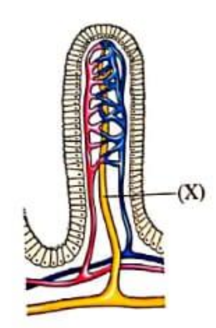
(a) The production of ATP from ADP in the grana.

(b) The production of ADP from ATP in the grana.

(c) The production of ATP from ADP in the stroma.

(d) The production of ADP from ATP in the stroma.

7 Which of the following the decrease in its production rate leads to a decrease in the food substances that are transferred to structure (X) ?



(a) Bile juice.

(b) Pepsin.

(c) Amylase.

(d) Sucrase.

6) When CO_2 is consumed in photosynthesis process, which of the following illustrates the path of CO_2 diffusion in the leaf after entering through the stomata ?

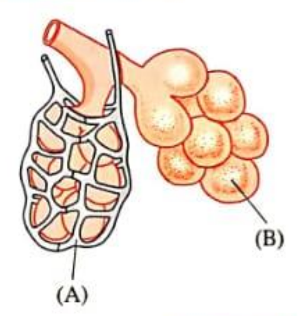
ⓐ Cell wall → Plasma membrane → Intercellular spaces → Cytoplasm → Plastid's membrane.

ⓑ Intercellular spaces → Cell wall → Plasma membrane → Cytoplasm → Plastid's membrane.

ⓒ Intercellular spaces → Plasma membrane → Cell wall → Plastid's membrane → Cytoplasm.

ⓓ Intercellular spaces → Cytoplasm → Plasma membrane → Cell wall → Plastid's membrane.

7) In the opposite figure, structure (B) is surrounded by a network of structures (A) to transfer .... easily.



ⓐ O_2 from (A) to (B)

ⓑ CO_2 from (B) to (A)

ⓒ H_2O from (B) to (A)

ⓓ O_2 from (B) to (A)

8) * "The lining of small intestine contains villi and the lining of large intestine contains convolutions", "both of them play an important role in the absorption process", ...

ⓐ the two statements are correct.

ⓑ the two statements are wrong.

ⓒ the first statement is correct and the second statement is wrong.

ⓓ the first statement is wrong and the second statement is correct.

9) * If the blood pressure value is 110 / 70 mm Hg, which of the following is synchronized with the measurement of number 110 ?

ⓐ The relaxation of ventricles.

ⓑ The contraction of atria.

ⓒ The opening of the valves with flaps.

ⓓ The opening of semi-lunar valves.

Answer the following questions (22 : 27) :

22 **Explain :** lymph plays an indirect role in blood clotting.

23 **In the opposite figure :**

What happens in case of : the absence of part (Y) from structure (X) ?

(Y)
(X)

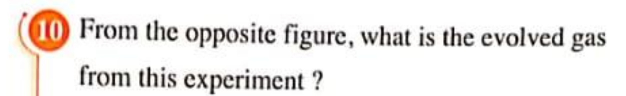
24 **What is the relation between :** the conversions of ATP into ADP and the change in the compounds during glycolysis ?

25 **The opposite figure** illustrates the formation of a blood clot inside an artery of a certain muscle. **Mention** the name of the harmful substance that accumulates in the tissues of the muscle. **Explain your answer.**

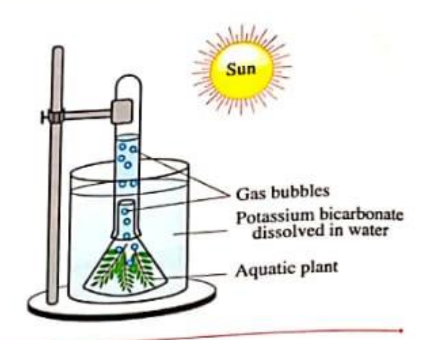
Artery
Vein
Blood clot
Blood vessels in the muscle

26 PGAL is formed during two important processes that you have studied, **determine the role of this compound in each of the two processes.**

EXAM 3



10 From the opposite figure, what is the evolved gas from this experiment ?

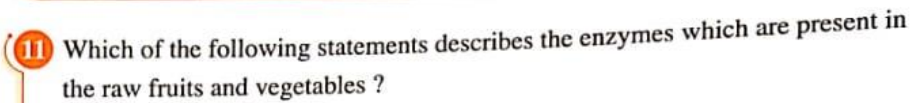


ⓐ Carbon dioxide.

ⓑ Hydrogen.

ⓒ Nitrogen.

ⓓ Oxygen.



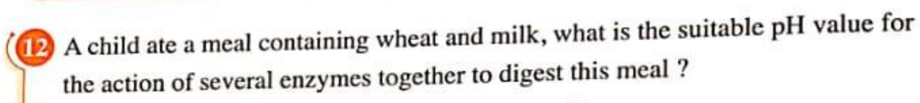
11 Which of the following statements describes the enzymes which are present in the raw fruits and vegetables ?

ⓐ The plant enzymes don't work inside the plant body.

ⓑ The enzymes change their substrates inside the human body.

ⓒ The enzymes that are present in them become inactive by heating and cooking.

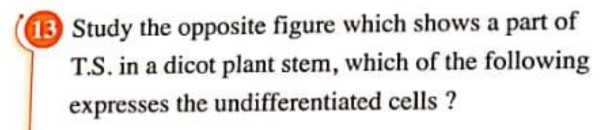
ⓓ The enzymes increase the activation energy.



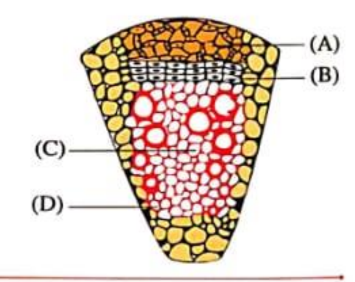
12 A child ate a meal containing wheat and milk, what is the suitable pH value for the action of several enzymes together to digest this meal ?

ⓐ 5 ⓑ 6

ⓒ 7 ⓓ 8



13 Study the opposite figure which shows a part of T.S. in a dicot plant stem, which of the following expresses the undifferentiated cells ?



ⓐ (A). ⓑ (B).

ⓒ (C). ⓓ (D).

14 From which are the walls of the blood vessels ends that spread among the cells of liver tissues formed ?

ⓐ Epithelial layer. ⓑ Epithelial and muscular layers.

ⓒ Muscular and connective layers. ⓓ Muscular layer.

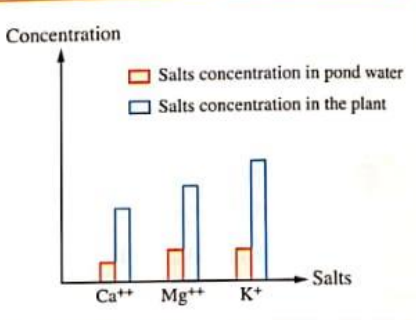
20 Study the following table :

Substance	Concentration in villus	Concentration in transport vessels
Na^+	155 mg / 100 ml	15 mg / 100 ml
Glycine	0.1%	0.02%
H_2O	75%	70%
Cl^-	1.01 mg / 100 ml	1.5 mg / 100 ml
Fat droplets	0.35%	0.33%

Which of the following substances will be transferred to the transport vessels by the same phenomenon ?

(a) Na^+ and Cl^-
(b) H_2O and Cl^-
(c) Cl^- and glycine.
(d) Glycine and fat droplets.

21 From the opposite graph, how salts are absorbed by the plant ?



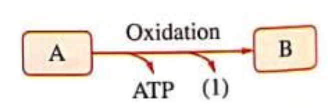
(a) Diffusion.
(b) Permeability.
(c) Active transport and permeability.
(d) Cation or anion exchange.

Answer the following questions (22 : 27) :

22 **Write the scientific term :** "Non-living plant structures, whereas the shape of their inner surface changes from a plant to another".

____

23 **From the opposite diagram,** if you know that (A) and (B) are intermediate compounds which are formed through one of the cellular respiration stages inside the mitochondria and each one of them consists of the same number of carbon atoms, **what** is the name of product no. (1) ?



____

21. Which of the following **doesn't** agree with glycolysis and the reactions that occur in the grana of the chloroplasts ?
ⓐ Both of them need energy.
ⓑ Both of them produce ATP molecules.
ⓒ Both of them linked with the presence of co-enzymes.
ⓓ In both of them a 3-carbon compound is formed.

Answer the following questions (22 : 27) :

22. **Explain :** ptyalin enzyme is secreted in an active form, while pepsin enzyme is secreted in an inactive form.

23. **What happens in case of :** the deposition of cutin on the external walls of the root hairs ?

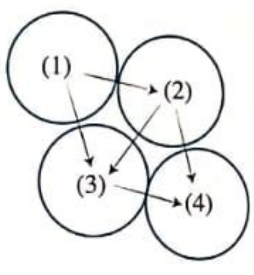
24. **Calculate :** the number of ATP molecules which is resulted from the oxidation of 10 glucose molecules inside a seed of a dicot plant at the beginning of the germination process.

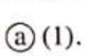
25. "The speed of the food substances transport in the plant depends on some external factors". **How far the statement is correct ? With explanation.**

General Exam 5

Choose the correct answer (1 : 21) :

1 ❋ The opposite figure represents the movement of water transfer by osmosis phenomenon among four adjacent plant cells, which of the following cells has the highest concentration of salts before water transferring ?





ⓐ (1).
ⓑ (2).
ⓒ (3).
ⓓ (4).

2 Which of the following **doesn't** agree with the chlorophyll function in the green plants ?

ⓐ The conversion of light energy into stored chemical energy in the food molecules.
ⓑ The absorption of the light energy that is required to perform the photosynthesis process.
ⓒ The storage of the kinetic energy of light as a chemical potential energy.
ⓓ The storage of the raw materials that are required to perform the photosynthesis process.

3 Which of the following **doesn't** agree with the occurrence of anaerobic respiration in the muscle ?

ⓐ The increase of lactic acid in blood.
ⓑ The depletion of oxygen in blood that reaches the muscle.
ⓒ The consumption of a large amount of NAD^+ molecules.
ⓓ The muscle fatigue.

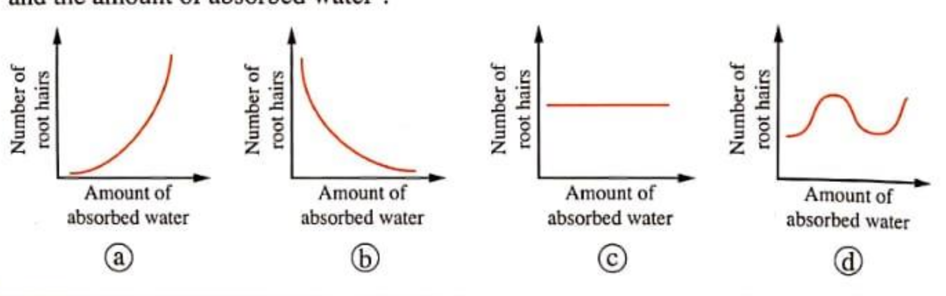
4 In which of the following cases the blood pressure value in human is the least ?

ⓐ The contraction of left ventricle.
ⓑ The relaxation of right atrium.
ⓒ The closure of bicuspid valve.
ⓓ The closure of semi-lunar valves.

10 What is the phenomenon in which the gas exchange process between the air present inside the alveolus and the blood in the two lungs takes place ?

ⓐ Osmosis. ⓑ Diffusion. ⓒ Active transport. ⓓ Imbibition.

11 Which of the following graphs represents the relation between the number of root hairs and the amount of absorbed water ?



12 * Which of the following blood components can the body make benefit from them through their different stages ?

ⓐ Platelets. ⓑ WBCs
ⓒ Plasma proteins. ⓓ RBCs

13 What is the process that occurs to NADH when pyruvic acid is converted into lactic acid ?

ⓐ Reduction. ⓑ Oxidation.
ⓒ Splitting. ⓓ Decomposition.

14 Which of the following digestive organs may have dysfunction in a person. So, the doctors advised him not to eat more food rich in fats ?

ⓐ Pancreas.
ⓑ Small intestine.
ⓒ Oesophagus.
ⓓ Stomach.

14 ✱ Study the following graph which shows some products of aerobic cellular respiration reactions :

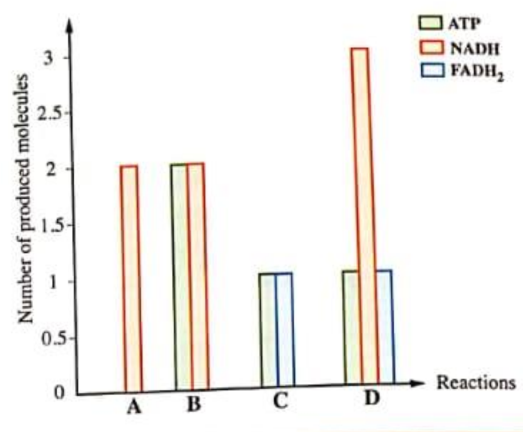
Which reaction occurs in the cytoplasm of the cell ?

ⓐ (A).

ⓑ (B).

ⓒ (C).

ⓓ (D).



15 Which type of food can be digested in both acidic and alkaline media ?

ⓐ Rice. ⓑ Potato. ⓒ Fat. ⓓ Meat.

16 Which of the following blood vessels contains the highest amount of glucose in human body after eating a balanced meal ?

ⓐ Inferior vena cava. ⓑ Hepatic portal vein.

ⓒ Pulmonary artery. ⓓ Hepatic vein.

17 What is the similarity between the green plants and purple-sulphur bacteria ?

ⓐ The type of chlorophyll in both of them.

ⓑ The source of hydrogen required for CO_2 fixation in both of them.

ⓒ The dark reactions in both of them.

ⓓ The secondary products of photosynthesis process in both of them.

18 What are the types of food needed by a person who practices bodybuilding ?

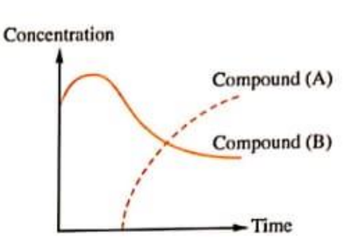
ⓐ Juices & vegetables.

ⓑ Rice & juices.

ⓒ Meat & juices.

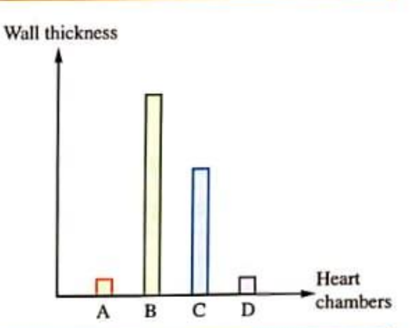
ⓓ Rice & vegetables.

15 The opposite graph represents the concentration of two types of compounds in the thigh muscles, during performing vigorous exercises, which of the following expresses (A) and (B) respectively ?



ⓐ ADP / Glucose.
ⓑ Lactic acid / Glucose.
ⓒ Glycogen / ATP
ⓓ Glycogen / Lactic acid.

16 Study the opposite graph which shows the difference in the thickness of the heart chambers in human, what is the chamber that is represented by column (B) ?

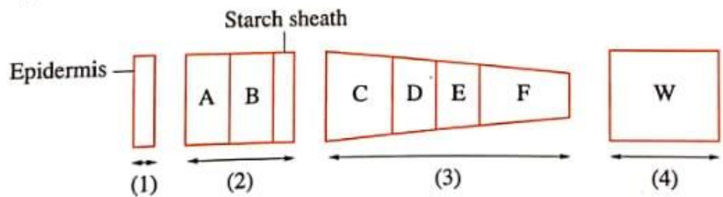


ⓐ Right atrium.
ⓑ Left ventricle.
ⓒ Left atrium.
ⓓ Right ventricle.

17 Which of the following expresses the characteristic features of the structures which are found in the cotton plant leaf's phloem ?

	Solutes concentration in the cell	Precipitation of lignin in the cell walls
ⓐ	Low	Low
ⓑ	Low	High
ⓒ	High	Absent
ⓓ	High	High

18 The following diagram shows 4 parts in the stem of a dicot plant arranged from outside to inside, study it then determine :



What is the function which the cells of the tissues (D) and (F) share ?

ⓐ Aeration.
ⓑ Elasticity.
ⓒ Sap storage.
ⓓ Sap transfer.

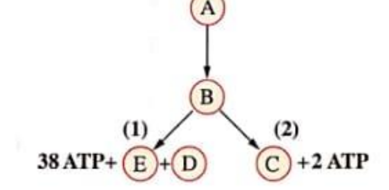
8 In each of the alcoholic fermentation and the acidic fermentation, 2 molecules of ATP are released. So, what is the expected number of the resulted kilocalories from the lysis of the released ATP molecules ?

ⓐ From the alcoholic fermentation is greater than that from the acidic fermentation.
ⓑ From the alcoholic fermentation is lower than that from the acidic fermentation.
ⓒ It is equal in the two types of fermentation.
ⓓ There is no fixed relation.

9 Which of the following statements **doesn't** illustrate the transport process of water in the plant ?

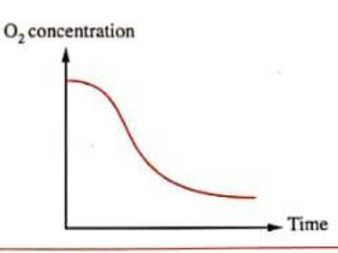
ⓐ Most of the released water from the leaf gets out through the stomata.
ⓑ The cohesion between the molecules of water causes the presence of a continuous column of water.
ⓒ The resulted effect from the transpiration process causes the presence of the continuous attraction of water column upward.
ⓓ The adhesion force between molecules of water and xylem vessels causes the column of water to be held continuously.

10 In the opposite diagram, what is the common factor between the two processes (1) and (2) ?



ⓐ The need to O_2
ⓑ The need to CO_2
ⓒ The need to energy.
ⓓ The need to FAD presence.

11 ✻ What is the blood vessel expressed in the opposite graph ?

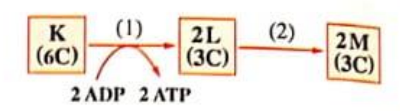


ⓐ Pulmonary artery.　ⓑ Renal artery.
ⓒ Vena cava.　ⓓ Hepatic vein.

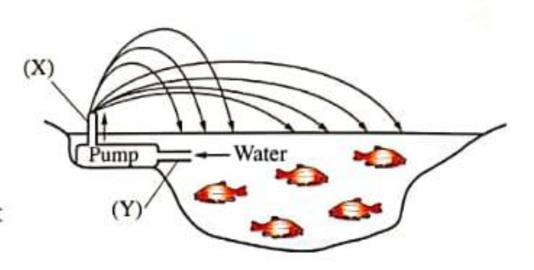
12 During preparation of a T.S. of a new dicot plant stem, iodine was added to the stem sample to enhance the examination, which tissue do you expect its cells **won't** be stained with the dark blue colour ?

ⓐ Cambium.　ⓑ Cortex.　ⓒ Medullary rays.　ⓓ Pith.

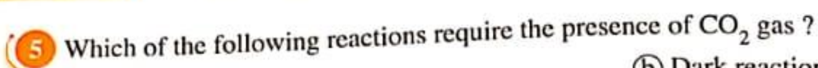
26 **The opposite diagram** illustrates a conversion in a muscular cell in the body, where the concentration of compound (M) increases during the muscular fatigue, **what** is the purpose of step no. (2) ?



27 **In the opposite figure,** the lake is supplied with the atmospheric oxygen through an external source to reach the fish, if you know that the work of this pump is similar to the work of the heart in the human blood circulation. **What** are the blood vessels that are similar to the work of each of (X) and (Y) ?

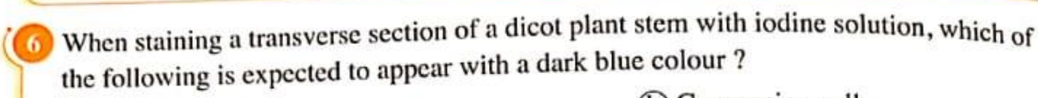


EXAM
8



5 Which of the following reactions require the presence of CO_2 gas ?

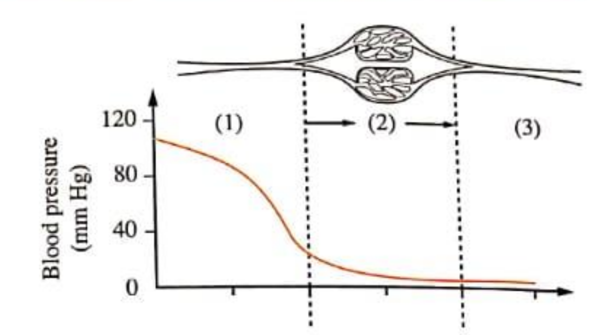
ⓐ Light reactions only.
ⓑ Dark reactions only.
ⓒ Light and dark reactions.
ⓓ Glycolysis reactions.



6 When staining a transverse section of a dicot plant stem with iodine solution, which of the following is expected to appear with a dark blue colour ?

ⓐ Xylem vessels.
ⓑ Companion cells.
ⓒ Cambium.
ⓓ The innermost row of cortex.

7 * The opposite figure illustrates the blood flow in the blood vessels, what does part no. (3) represent ?



ⓐ Artery.
ⓑ Vein.
ⓒ Blood capillaries.
ⓓ Lymphatic vessel.

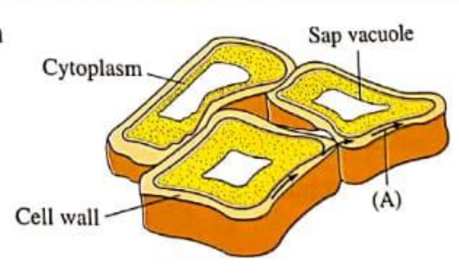
8 What is the ratio between the number of $FADH_2$ molecules to that of NADH molecules that are resulted from the complete oxidation of a molecule of glucose in aerobic conditions ?

ⓐ 1 : 5
ⓑ 3 : 1
ⓒ 5 : 1
ⓓ 1 : 3

9 Gallbladder was removed from a person, which of the following is expected to occur ?

ⓐ He can't eat carbohydrates.
ⓑ He can eat fats in small amounts.
ⓒ He can take drinks only.
ⓓ He can't eat more than one big meal daily.

10 From the opposite figure, what is the phenomenon by which substance (A) transfers ?

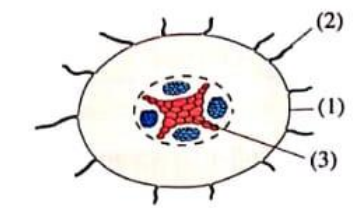


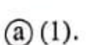
ⓐ Osmosis.
ⓑ Imbibition.
ⓒ Diffusion.
ⓓ Active transport.

5 * Which of the following is synchronized with the relaxation of the walls of the right atrium ?

ⓐ Opening of mitral valve.
ⓑ Opening of pulmonary valve.
ⓒ Opening of tricuspid valve.
ⓓ Closure of aortic valve.

6 The opposite figure illustrates a transverse section in the plant root, which of the following parts absorb(s) water and salts ions mainly ?




ⓐ (1).
ⓑ (2).
ⓒ (1) and (2).
ⓓ (3).

7 Which of the following helps in absorbing oxygen rapidly from the blood that is present in the two lungs ?

ⓐ The air that enters in the two lungs contains a lower amount of O_2 than the air comes out from them.
ⓑ The wall of alveolus is thick and has a large surface area.
ⓒ The wall of alveolus is thin and has a large surface area.
ⓓ The concentration of O_2 in the blood is higher than its concentration in the alveolus.

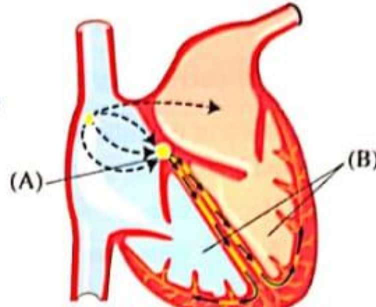
8 Which of the following statements **doesn't** agree with the heart blood circulation ?

ⓐ When the two ventricles contract, the valves between atria and ventricles close.
ⓑ When the two ventricles relax, the semi-lunar valves close.
ⓒ When the two atria contract, the semi-lunar valves open.
ⓓ When the two atria contract, the valves between atria and ventricles open.

9 * What is the difference between the fermentation in yeast fungus and the fermentation in a fatigued muscle fiber ?

ⓐ The increase in the released energy amount from one molecule of glucose.
ⓑ Releasing less amount of CO_2
ⓒ The breaking down of a lower number of chemical bonds.
ⓓ The fats and proteins aren't used as a source of energy.

25 **The opposite figure illustrates a longitudinal section in the human heart and the arrows represent the direct movement of the electric pulse which makes the muscle start to contract.**



Illustrate :

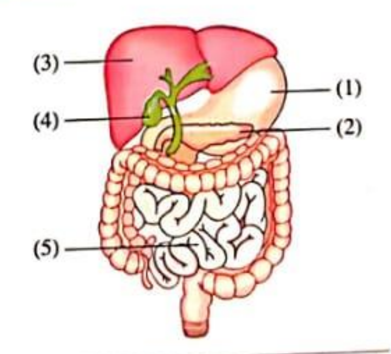
(a) The reason for the delaying in the passage of the electric pulse that occurs at point (A).

(b) The importance of (B) contraction from the base.

26 "The aerobic respiration may occur after the anaerobic respiration".

How far the statement is correct ? With explanation.

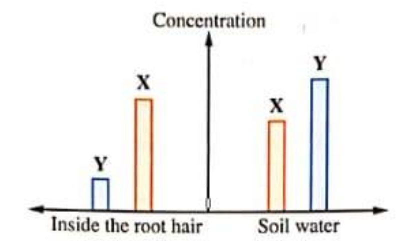
27 **The opposite figure illustrates a part of the human digestive system, write the number and the name of the organ :**



(a) That is responsible for the adjustment of the pH value in organ no. (5).

(b) That contains the highest concentration of hydrogen ions.

18 The following graph shows the concentration of ion (X) and ion (Y) for elements needed by a plant in the soil and inside the root hair of this plant :



What are the physical phenomena that lead to transferring (X) and (Y) respectively ?

ⓐ Active transport and diffusion.

ⓑ Selective permeability and active transport.

ⓒ Diffusion and selective permeability.

ⓓ Selective permeability and diffusion.

19 ❋ What is the number of the produced ATP molecules after the electron transport chain from 10 molecules of pyruvic acid ?

ⓐ 150

ⓑ 170

ⓒ 180

ⓓ 190

20 What happens if you put a plant cell in a sucrose solution whose concentration is more than the cell osmotic pressure ?

ⓐ It will swell, due to the entry of H_2O inside its sap vacuole.

ⓑ It will shrink, due to H_2O exit from its sap vacuole.

ⓒ It will not be affected.

ⓓ It will burst.

21 What is the required condition for exiting 6 molecules of CO_2 during the aerobic cellular respiration ?

ⓐ Glycolysis.

ⓑ Pyruvic acid oxidation and completing two Krebs cycles.

ⓒ The occurrence of complete oxidative phosphorylation.

ⓓ The cell consumes more O_2

11 What happens to ketoglutaric acid when it is converted into succinic acid during cellular respiration ?

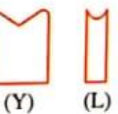
ⓐ It combines with O_2
ⓑ It consumes ATP molecules.
ⓒ It consumes CO_2
ⓓ It loses electrons.

12 Which of the following represent the reactants (substrates) for both enzymes (A) & (B) respectively ?

ⓐ (Y) & (L).
ⓑ (Z) & (L).
ⓒ (Y) & (X).
ⓓ (X) & (Z).

Enzyme (A) (B)

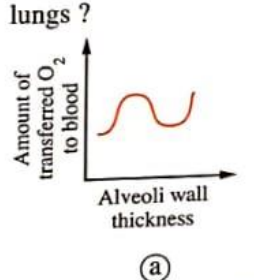
Substrate



(Z) (X) (Y) (L)

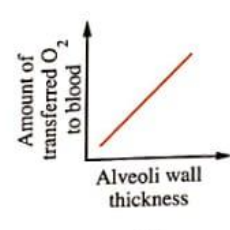
13 Which of the following **doesn't** agree with glycolysis reactions and the reactions which occur in the chloroplast stroma ?

ⓐ Each of them doesn't occur in one step only.
ⓑ PGAL compound is formed in both of them.
ⓒ Both of them need energy.
ⓓ Each of them produces CO_2

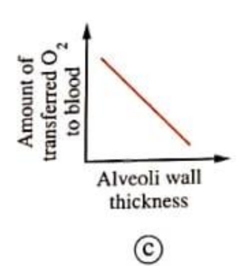
14 Which of the following graphs expresses the efficiency of air sacs (alveoli) in the two lungs ?



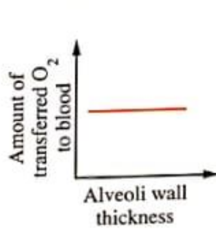
ⓐ



ⓑ



ⓒ



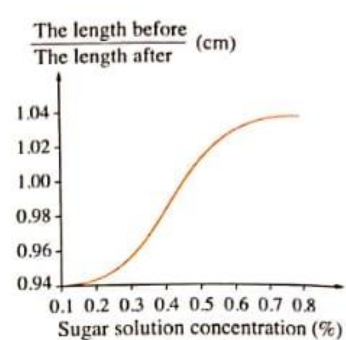
ⓓ

15 Which of the following occurs when placing a plant cell in a salt solution whose temperature is 90°C ?

ⓐ Water and salts absorption completely stops.
ⓑ Salts absorption completely stops and water absorption continues.
ⓒ Water and salts absorption partially stops.
ⓓ Water absorption stops only.

EXAM 9

21 Several sections of castor plant having the same length were put in a serial concentrations of sucrose sugar, their length was measured before and after treating, the opposite graph shows the rate of change in length, which of the following concentrations for sucrose solution has the same concentration of cell sap of the plant before soaking in the sugar solution ?



ⓐ 0.1%

ⓑ 0.25%

ⓒ 0.45%

ⓓ 0.8%

Answer the following questions (22 : 27) :

22 **Give reason for :** the heartbeats of boxing champions reach about 180 beats/minute at the top of the competition.

____

____

23 **What happens in case of :** the exposure of the plant to an infection with a microbe and it reaches the xylem vessels (according to the transport process) ?

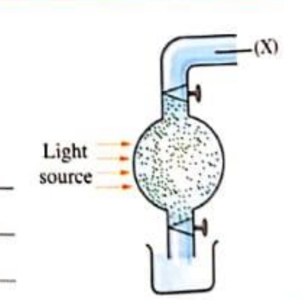
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24 **The opposite figure illustrates the experiment of Calvin, what do you expect if** the system is supplied with element (X) intermittently ?

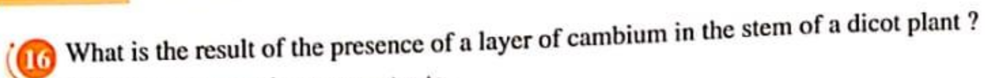


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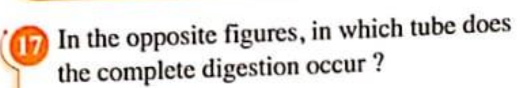
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EXAM 7

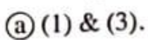


16 What is the result of the presence of a layer of cambium in the stem of a dicot plant ?

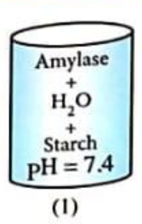
ⓐ An increase in the transport rate.
ⓑ The widening of the secondary xylem cavities.
ⓒ A decrease in the stem support.
ⓓ An increase in the length of phloem tubes.

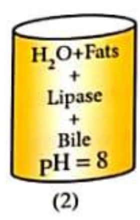


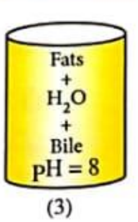
17 In the opposite figures, in which tube does the complete digestion occur ?



ⓐ (1) & (3).
ⓑ (3) only.
ⓒ (1) & (2).
ⓓ (2) only.

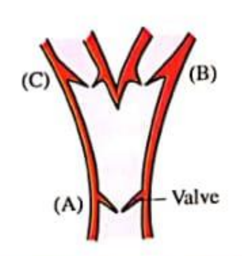






18 The opposite figure shows the connection between two veins together, which of the following shows the direction of venous blood ?

ⓐ (C) ⟶ (A) and (A) ⟶ (B).
ⓑ (B) ⟶ (C) and (A) ⟶ (C).
ⓒ (A) ⟶ (C) and (A) ⟶ (B).
ⓓ (C) ⟶ (A) and (B) ⟶ (A).



19 Which of the following tissues is responsible for aeration in plant leaves ?

ⓐ Palisade tissue.
ⓑ Spongy tissue.
ⓒ Collenchyma tissue.
ⓓ Vascular tissue.

20 What is the number of the resulted ATP molecules directly from Krebs cycle during the oxidation of a maltose molecule ?

ⓐ 1 ⓑ 2 ⓒ 4 ⓓ 8

21 Human body contains a group of fluids that differ in their structure, which of the following expresses the components of blood plasma ?

	Water	Urea	Antibodies	WBCs
ⓐ	✓	✓	✓	×
ⓑ	✓	✓	×	×
ⓒ	✓	✓	✓	✓
ⓓ	×	×	✓	✓

✓: Present
×: Absent

9 Which of the following is found in the human blood plasma in the normal cases ?

ⓐ Fibrin.
ⓑ Thromboplastin.
ⓒ Thrombin.
ⓓ Fibrinogen.

10 Which of the following is(are) required for accomplishing the Krebs cycle in the presence of acetyl groups ?

ⓐ Glucose.
ⓑ Oxygen.
ⓒ Respiratory enzymes.
ⓓ ATP molecules.

11 Which of the following food substances **wouldn't** be digested, if it was treated with drops of the pancreatic juice that is present in the pancreatic duct ?

ⓐ Meat.
ⓑ Peanut butter.
ⓒ Bread.
ⓓ Rice.

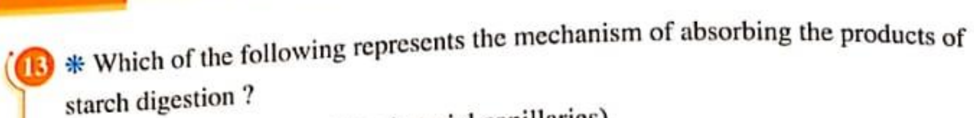
12 * "The different food substances like sugar of sugarcane and amino acids transfer through the sieve tubes of phloem". Which of the following statements describes this process better ?

ⓐ Sugar transfers by active transport in some sieve tubes, while amino acids transfer by diffusion in the other sieve tubes.
ⓑ Sugar and amino acids transfer together by active transport in the same sieve tube of phloem.
ⓒ The flow rate of sugar and amino acids increases in two different directions in the same sieve tube of phloem.
ⓓ The flow rate of sugar and amino acids increases in different directions of different sieve tubes at the same time.

13 In the opposite figure, what is the pressure value in vessel (X) ?

X

ⓐ 10 mm Hg
ⓑ 70 mm Hg
ⓒ 130 mm Hg
ⓓ 160 mm Hg



13 * Which of the following represents the mechanism of absorbing the products of starch digestion ?

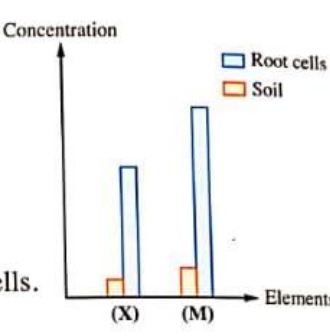
(a) Diffusion to the arterioles (arterial capillaries).

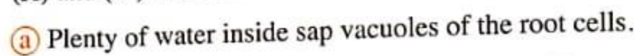
(b) Active transport to the lacteal vessel.

(c) Diffusion to the lacteal vessel.

(d) Active transport to the venules (venous capillaries).

14 Study the opposite graph which shows the plant need for (X) and (M) elements to perform vital processes, what is the factor that helps in increasing the concentration of (X) and (M) inside the root cells ?





(a) Plenty of water inside sap vacuoles of the root cells.

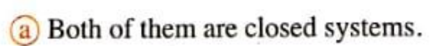
(b) The decrease of sugar inside sap vacuoles of the root cells.

(c) The decrease of O_2 inside the root cells.

(d) Plenty of O_2 inside the root cells.

15 The opposite figure shows the relation between the lymphatic system and the circulatory system, what do you deduce from this figure ?

Lymphatic capillaries
Lymphatic vessels
Vein
Artery
Lymphatic node
Heart

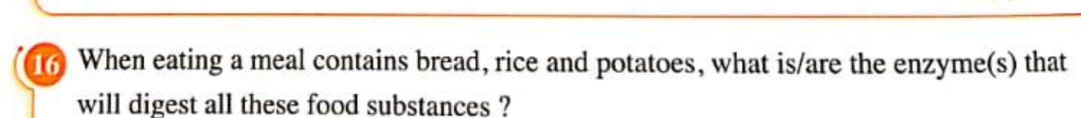


(a) Both of them are closed systems.

(b) Both of them are opened systems.

(c) Circulatory system is closed, while lymphatic system is opened.

(d) Circulatory system is opened, while lymphatic system is closed.



16 When eating a meal contains bread, rice and potatoes, what is/are the enzyme(s) that will digest all these food substances ?

(a) Amylase only.

(b) Lipase only.

(c) Amylase and lipase.

(d) Lipase and peptidase.

EXAM 6

15 Which of the following phenomena work on transferring the solutes from and to the cell of filamentous-shaped alga ?

ⓐ Diffusion and imbibition.

ⓑ Diffusion and active transport.

ⓒ Imbibition and active transport.

ⓓ Diffusion, osmosis and active transport.

16 Which of the following is accompanied by the formation of glucose 6-phosphate ?

ⓐ Energy production.

ⓑ Energy consumption.

ⓒ CO_2 production.

ⓓ O_2 consumption.

17 * What is the result of absence of the pits from xylem vessels in a plant leaf ?

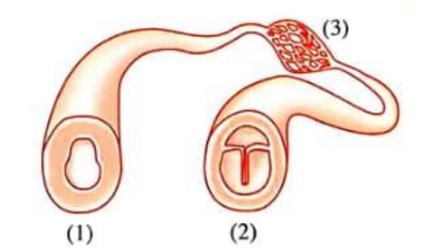
ⓐ Increasing in the salts and H_2O transport to the palisade cells.

ⓑ Stopping the light and dark reactions.

ⓒ Stopping the transport of sucrose and amino acids.

ⓓ Increasing the dark reactions rate.

18 In the opposite figure, what do the blood vessels from (1) : (3) represent respectively ?



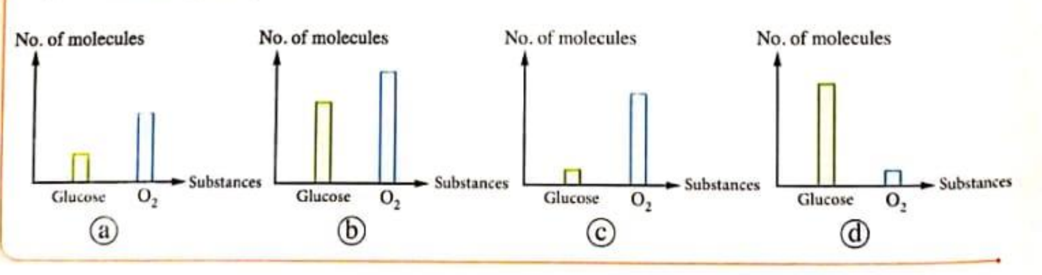
ⓐ Vein / Artery / Blood capillaries.

ⓑ Artery / Blood capillaries / Vein.

ⓒ Blood capillaries / Artery / Vein.

ⓓ Artery / Vein / Blood capillaries.

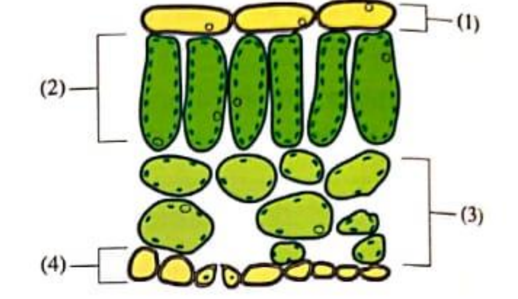
19 * Which of the following graphs represents the fetus need for glucose and O_2 to produce energy only ?



General Exam 2

Choose the correct answer (1 : 21) :

1 The opposite figure illustrates a part of a transverse section in a leaf of a plant, which of the following tissues is the most efficient to perform the photosynthesis process ?



ⓐ (1). ⓑ (2).

ⓒ (3). ⓓ (4).

2 Which of the following happens in case of the presence or absence of oxygen ?

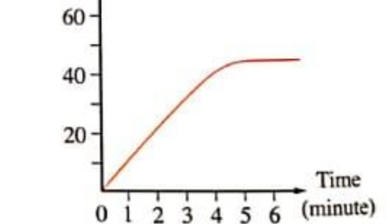
ⓐ Glycolysis.

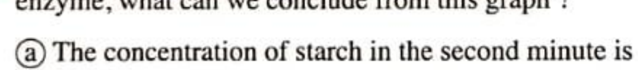
ⓑ The conversion of pyruvic acid into acetyl coenzyme (A).

ⓒ Citric acid cycle.

ⓓ Oxidative phosphorylation.

3 ✻ The opposite graph illustrates the activity of amylase enzyme, what can we conclude from this graph ?





ⓐ The concentration of starch in the second minute is lower than that in the fourth minute.

ⓑ The concentration of glucose in the fourth minute is higher than that in the first minute.

ⓒ The concentration of maltose in the second minute is higher than that in the fourth minute.

ⓓ The concentration of maltose in the fourth minute is higher than the concentration of starch.

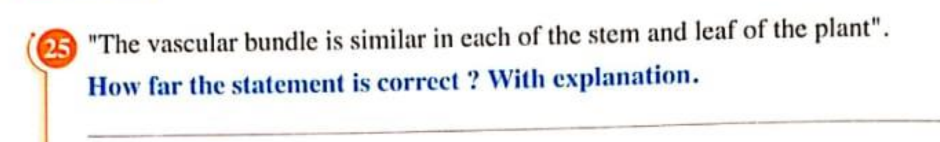
4 ✻ Which of the following percentages are equal ?

ⓐ The percentage of O_2 in the inhaled air with its percentage in the alveolar air.

ⓑ The percentage of CO_2 in the exhaled air with its percentage in the alveolar air.

ⓒ The percentage of N_2 in the inhaled air with its percentage in the exhaled air.

ⓓ The percentage of H_2O in the inhaled air with its percentage in the exhaled air.

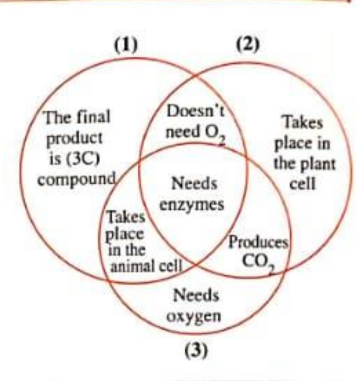


25 "The vascular bundle is similar in each of the stem and leaf of the plant".

How far the statement is correct ? With explanation.

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26 **The opposite figure illustrates some vital processes that occur in the cells of living organisms, examine it, then answer :**

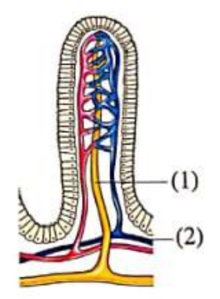


(a) How many ATP molecules are produced from the complete oxidation of one molecule of glucose in process no. (3) ?

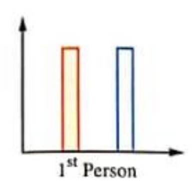
(b) Arrange the processes from (1) : (3) descendingly, according to their energy production.

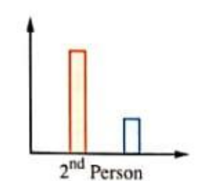
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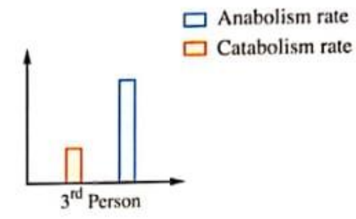
27 **From the opposite figure, determine** by arrows a simple pathway for the absorbed food substances through the two vessels no. (1) and (2), till reaching the heart.



14 The following graphs describes the relation between the rate of anabolism and catabolism in 3 people differ in the age-stage :







Which of the following represents the arrangement of the 3 people from the first to the third ?

ⓐ Childhood - Youth - Elderhood.

ⓑ Youth - Childhood - Elderhood.

ⓒ Elderhood - Childhood - Youth.

ⓓ Youth - Elderhood - Childhood.

15 The living cells keep the internal concentration of ions which differs from the external concentration, what is the reason for continuing the concentration difference ?

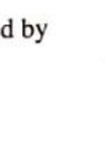
ⓐ Cells' walls. ⓑ Cells' vacuoles.

ⓒ Cells' membranes. ⓓ Plastids.

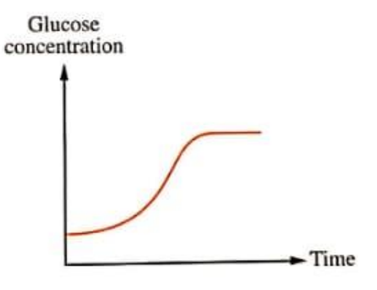
16 Which of the following **doesn't** happen during the dark reactions ?

ⓐ CO_2 fixation. ⓑ $NADPH_2$ oxidation.

ⓒ Photosynthetic phosphorylation. ⓓ ATP consumption.



17 What is the blood vessel which is represented by the curve in the opposite graph ?



ⓐ Pulmonary artery.

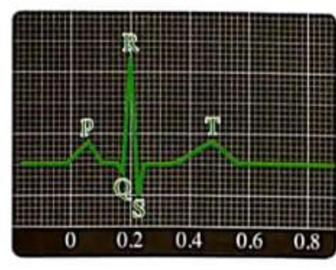
ⓑ Hepatic portal vein.

ⓒ Hepatic vein.

ⓓ Hepatic artery.

19 The following figure represents a part of the normal electrocardiogram for the human heart, if you know that :

- Part (P) represents contraction of atria to pump the blood to ventricles.
- Part (QRS) refers to the contraction of ventricles to pump the blood outside the heart.
- Part (T) expresses the secondary contraction of ventricles to pump blood residues outside the heart.

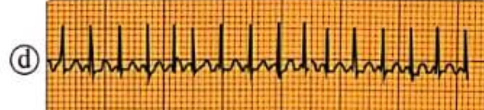


Which of the following diagrams represents the slow heartbeats rate ?

ⓐ 

ⓑ 

ⓒ 

ⓓ 

20 Normal plants are cultivated in desert and small number of them adapted well with this environment, which of the following factors its increase leads to the adaptation of these plants ?

ⓐ The tallness of vegetative parts of the plant.

ⓑ The concentration of cell sap of root cells.

ⓒ The shortness of the root.

ⓓ The small volume of sap vacuoles of the root.

21 In which of the following cases is the highest value of blood pressure ?

ⓐ Relaxation of left ventricle.

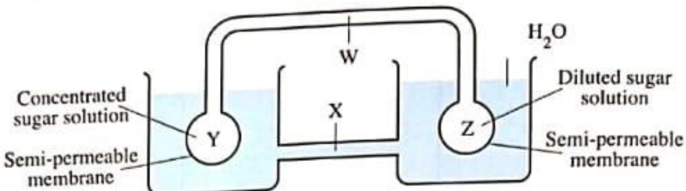
ⓑ Contraction of right ventricle.

ⓒ Opening of mitral valve.

ⓓ Opening of semi-lunar valves.

EXAM 5

18 * The following figure shows a model for the transport process of organic substances in the plant :



Which of the following choices describes the structures from (Y) : (Z) and the correct direction for the transport process through structure (W) ?

	Phloem	Xylem	Roots	Leaves	Transport direction
ⓐ	W	X	Y	Z	Z ⟶ Y
ⓑ	W	X	Z	Y	Y ⟶ Z
ⓒ	X	W	Y	Z	Y ⟶ Z
ⓓ	X	W	Z	Y	Z ⟶ Y

19 When we put the RBCs in a salt solution of unknown concentration for a period of time, the cells shrink, what do you conclude from this ?

ⓐ The concentration of salts in the solution is less than their concentration in the blood cells.

ⓑ The concentration of salts in the solution is more than their concentration in the blood cells.

ⓒ The concentration of salts in the solution is equal to their concentration in the blood cells.

ⓓ None of the previous is correct.

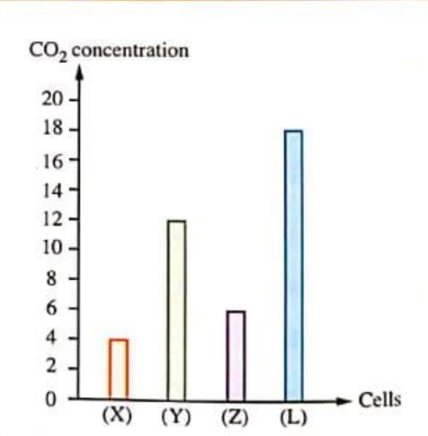
20 * The opposite graph represents the amount of released CO_2 during the aerobic respiration process, in which cell are the three glucose molecules oxidized completely ?

ⓐ (X).

ⓑ (Y).

ⓒ (Z).

ⓓ (L).



19 The narrowing of the xylem tubes diameter in plant stem causes ....

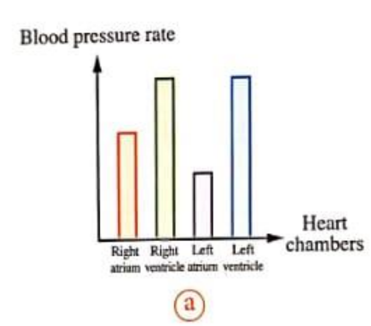
ⓐ the inability of water transfer through xylem tubes.

ⓑ water and salts transfer by capillarity phenomenon.

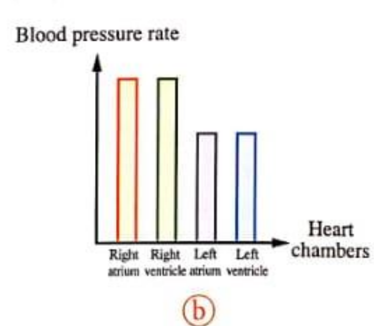
ⓒ water and salts transfer by capillarity phenomenon and adhesion.

ⓓ the lignin precipitation inside xylem tubes' cavity.

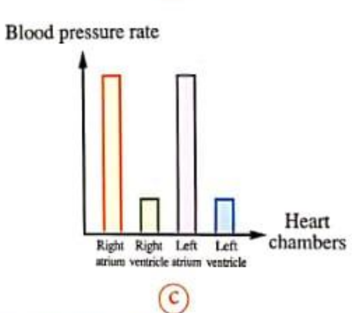
20 Which of the following graphs expresses the strength of chambers muscles contraction in the human heart ?



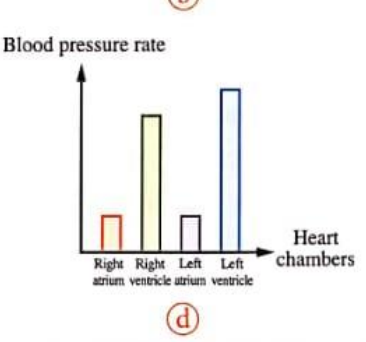
ⓐ



ⓑ



ⓒ



ⓓ

21 Which of the following uses the sunlight directly ?

ⓐ Production of ATP molecules.

ⓑ Movement of chlorophyll molecule electrons.

ⓒ Water molecules splitting.

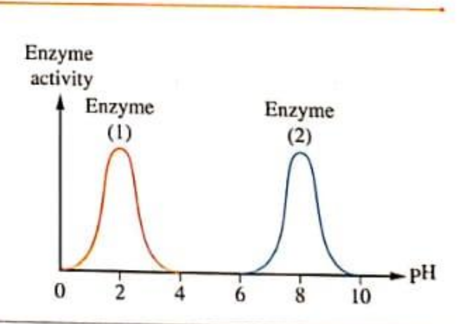
ⓓ $NADPH_2$ molecules formation.

24 **Explain :** glycolysis process needs energy.

25 If you know that the saline solution which is given through a venous injection, its concentration is 0.9%, **deduce** what happens to the red blood corpuscles when the concentration of the saline solution is 1% or 0.5%. **Explain your answer.**

26 "The blood flow factors differ in arteries from veins".
How far the statement is correct ? With explanation.

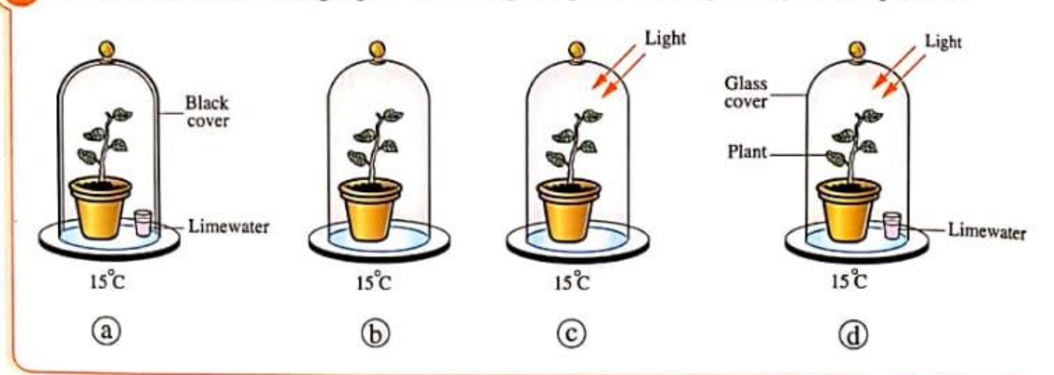
27 **The opposite graph** illustrates the activity of two enzymes that affect the same food substance, **deduce** the name of the two enzymes (1) and (2).



General Exam 4

Choose the correct answer (1 : 21) :

1 In which of the following figures can the plant perform the photosynthesis process ?



2 Which of the following **doesn't** agree with glycolysis and the reactions which occur in the grana of the chloroplast ?

ⓐ Both of them need energy.

ⓑ ATP molecules are released from both of them.

ⓒ Their occurrence is associated with the presence of coenzymes.

ⓓ 3-carbon compound is formed in each one of them.

3 After performing a muscular effort, which of the following blood vessels carries the lowest concentration of CO_2 ?

ⓐ Hepatic vein.

ⓑ Pulmonary artery.

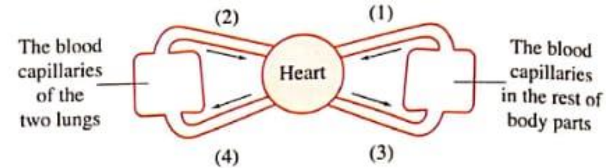
ⓒ Pulmonary vein.

ⓓ Vena cava.

4 * What is the number of CO_2 molecules which is resulted from Krebs cycle when a molecule of maltose is completely oxidized ?

ⓐ 2 ⓑ 4 ⓒ 6 ⓓ 8

9 * In the opposite figure, which of the blood vessels carry oxygenated blood ?



ⓐ (1) & (2).

ⓑ (1) & (3).

ⓒ (2) & (3).

ⓓ (2) & (4).

10 What happens during the passage of the food bolus in the oesophagus ?

ⓐ The proteins digestion starts.

ⓑ The fats digestion starts.

ⓒ The carbohydrates digestion continues.

ⓓ The digestion process stops.

11 What should be present for the occurrence of the anaerobic cellular respiration ?

ⓐ O_2

ⓑ CO_2

ⓒ Specific enzymes.

ⓓ FAD

12 When will the root pressure stop ?

ⓐ When the water comes out from the stem by exudation.

ⓑ When the water transfers to root cells by the imbibition phenomenon.

ⓒ When it increases more than 2 atmospheric pressure (atm).

ⓓ When it becomes equal to the pressure of the water column in xylem vessels.

13 Which of the following may occur if suberin precipitated on the double membrane of chloroplasts ?

ⓐ Difficulty in the light passage.

ⓑ Chlorophyll won't be formed.

ⓒ High speed of O_2 formation.

ⓓ Water passes easily.

General Exam 6

Choose the correct answer (1 : 21) :

1 Which of the following elements its absence **doesn't** affect the photosynthesis process ?

ⓐ Iron.

ⓑ Phosphorus.

ⓒ Magnesium.

ⓓ Calcium.

2 What is the similarity between the lymphatic system and the circulatory system ?

ⓐ The presence of nodes that work on getting rid of pathogens.

ⓑ The presence of a network of arteries.

ⓒ The presence of a network of blood capillaries.

ⓓ It has an immunization function.

3 Which of the following tissues has the ability to divide mitotically in the plant ?

ⓐ Xylem.

ⓑ Phloem.

ⓒ Palisade tissue.

ⓓ Cambium.

4 * In the opposite diagram, what do the two processes (1) and (2) represent ?

Ⓐ (12C) $\xrightarrow{(1)}$ Ⓑ $\xrightarrow{(2)}$ Ⓓ + Ⓔ + 38 ATP

ⓐ (1) is hydrolysis and (2) is catabolism.

ⓑ (1) is anabolism and (2) is hydrolysis.

ⓒ (1) is anabolism and (2) is catabolism.

ⓓ (1) is catabolism and (2) is anabolism.

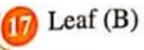
5 What is the importance of water in photosynthesis process ?

ⓐ A solvent for carbon dioxide gas.

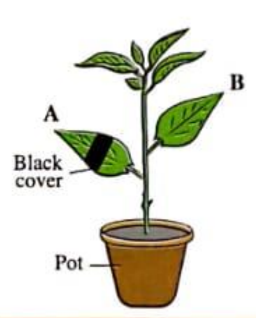
ⓑ A source for the evolved oxygen.

ⓒ A source for hydrogen that is required for the reduction process.

ⓓ A receiver for light energy.



17 Leaf (B) produces $C_6H_{12}O_6$ .... leaf (A).



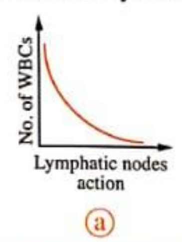
ⓐ more than

ⓑ less than

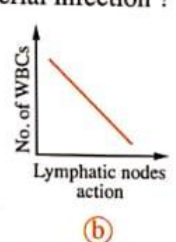
ⓒ equal to

ⓓ no correct answer

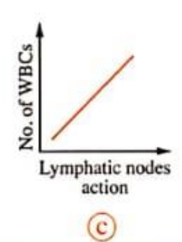
18 Which of the following graphs represents the immunity performance for a person body in the first days of a bacterial infection ?



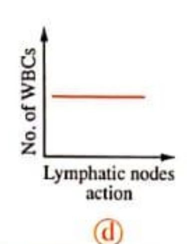
ⓐ



ⓑ



ⓒ



ⓓ

19 * In your opinion, why does NADH give 3 ATP molecules, while $FADH_2$ gives 2 ATP molecules only ?

ⓐ NADH molecules give their electrons to the cytochrome at higher energy levels.

ⓑ $FADH_2$ molecules give their electrons to the cytochrome at higher energy levels.

ⓒ NADH molecules don't give all their electrons to the cytochromes.

ⓓ $FADH_2$ molecules don't give all their electrons to the cytochromes.

20 Which of the following is permeable to water ?

ⓐ Cellulose walls.

ⓑ Walls covered by lignin

ⓒ Walls covered by cutin and suberin.

ⓓ Plasma membranes and cellulose walls.

General Exam 1

Choose the correct answer (1 : 21) :

1. What are the two valves which allow the blood to pass nearly at the same time ?
   - ⓐ The mitral valve and pulmonary valve.
   - ⓑ The pulmonary valve and aortic valve.
   - ⓒ The mitral valve and aortic valve.
   - ⓓ The tricuspid valve and aortic valve.

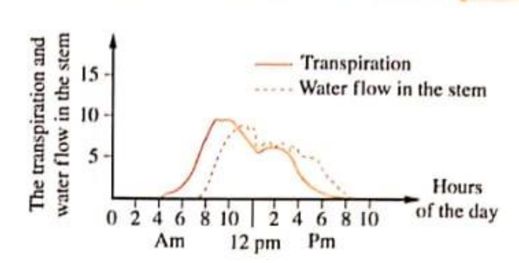
2. Which of the following conversions includes the oxidation process of coenzymes ?
   - ⓐ Pyruvic acid from phosphoglyceraldehyde.
   - ⓑ Succinic acid from ketoglutaric acid.
   - ⓒ Malic acid from succinic acid.
   - ⓓ Lactic acid from pyruvic acid.

3. In an experiment, a student put four potato slices (the length of each slice was 5 cm) in salt solutions with different concentrations, then he recorded the results in the following table depending on the recorded results, which of the following expresses the solution that has the highest concentration ?

Salt solution	The length of the slice after 30 minutes
ⓐ	4.5
ⓑ	4.8
ⓒ	5
ⓓ	5.3

4. Which of the following represents the correct arrangement of the stem tissues from inside to outside ?
   - ⓐ Epidermis / Cortex / Vascular bundle / Pericycle.
   - ⓑ Vascular bundle / Pericycle / Cortex / Epidermis.
   - ⓒ Vascular bundle / Epidermis / Cortex / Pericycle.
   - ⓓ Pericycle / Epidermis / Vascular bundle / Cortex.

5 * What do you conclude from your study to the opposite graph ?

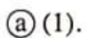


ⓐ The transpiration rate is constant all the day.

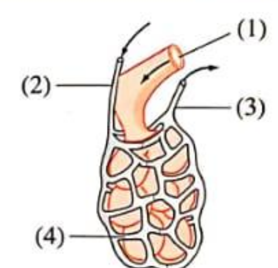
ⓑ There is no relation between the water flow in the stem and the transpiration rate.

ⓒ The highest flow of water in the stem is delayed than the highest transpiration rate.

ⓓ The transpiration rate can't reach zero.



6 From the opposite figure, which of the following structures contains the highest concentration of O_2 gas ?



ⓐ (1).

ⓑ (2).

ⓒ (3).

ⓓ (4).

7 Which of the following statements is applied to the digestive juices that are secreted by liver and pancreas ?

ⓐ They digest the same food substances.

ⓑ They work at the same pH value.

ⓒ Their enzymes need activators to work.

ⓓ The same products of digestion are produced by their action.

8 How is the equation of this reaction ($C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + 38$ ATP) affected, when the number of coenzymes decreases in mitochondria ?

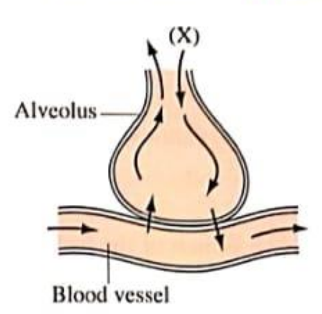
ⓐ The glucose will be formed again.

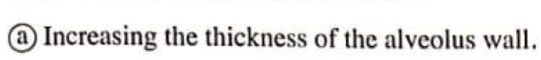
ⓑ Water will not be from the reaction products.

ⓒ The number of the resulted ATP molecules will decrease.

ⓓ The number of CO_2 molecules will decrease.

6 In the opposite figure, which of the following factors works on increasing the penetration rate of gas (X) from the alveolus to the blood vessel ?





ⓐ Increasing the thickness of the alveolus wall.

ⓑ Increasing the surface area of the alveoli.

ⓒ Decreasing the concentration of gas (X) in the alveoli.

ⓓ Decreasing the respiration rate.

7 Which of the following valves direct the blood route which contains the highest percentage of carbo-aminohaemoglobin substance ?

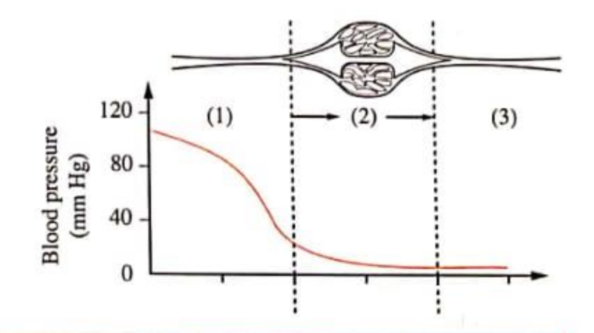
ⓐ Mitral valve and tricuspid valve.

ⓑ Mitral valve and aortic valve.

ⓒ Pulmonary valve and aortic valve.

ⓓ Tricuspid valve and pulmonary valve.

8 * The opposite figure illustrates the blood flow in the blood vessels, what does part no. (1) represent ?





ⓐ Artery.

ⓑ Vein.

ⓒ Blood capillaries.

ⓓ Lymphatic vessel.

9 Which of the following statements agrees with Krebs cycle ?

ⓐ It is always related to glycolysis process to form pyruvic acid.

ⓑ It occurs inside the mitochondria.

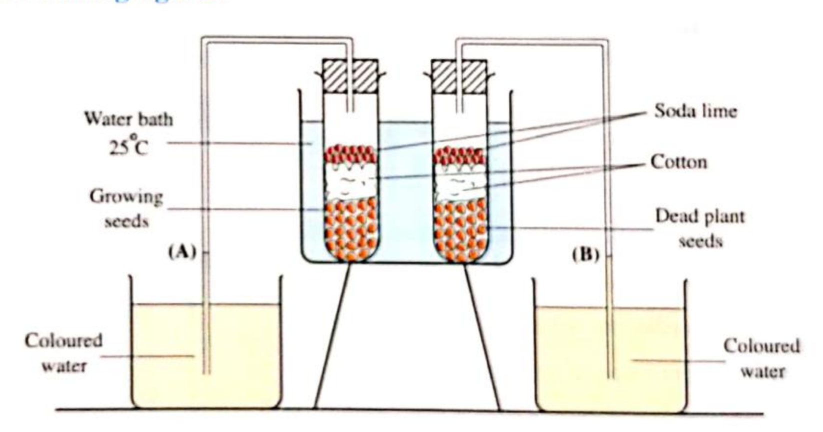
ⓒ The biggest direct source to produce ATP molecules in the cell.

ⓓ Citric acid is an intermediate compound in it.

25 "The respiration rates may increase in the root hair during the absorption of the mineral salts". **How far the statement is correct ? With explanation.**

26 The doctor may recommend a medicine for the patient, that is taken through venous injection not by mouth. **Suggest two reasons for that.**

27 **From the following figure :**



Deduce what happens in each level of (A) and (B) after passing a period of time. **Explain your answer.**



EXAM 7

6 Which of the following gives the highest blood pressure in aorta ?

ⓐ Right atrium contraction.

ⓑ Left atrium contraction.

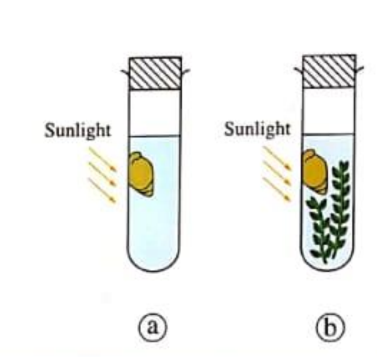
ⓒ Right ventricle contraction.

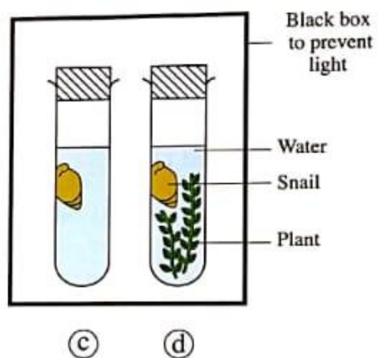
ⓓ Left ventricle contraction.

7 Which of the following substances **doesn't** transfer through the plant transport system ?

ⓐ H_2O ⓑ Glucose. ⓒ Cellulose. ⓓ Mg^{2+}

8 * You have 4 test tubes as shown in the following figure, in which tube will the O_2 concentration decrease rapidly ?





ⓐ ⓑ ⓒ ⓓ

9 What is the similarity between the corn plant and *Orobanche* plant ?

ⓐ Performing photosynthesis process.

ⓑ The fixation of CO_2 gas.

ⓒ Converting low-energy compounds into high-energy compounds.

ⓓ Converting organic compounds into inorganic compounds.

10 In which of the following plants do you expect that the osmotic pressure is vanished ?

ⓐ Cotton. ⓑ Bean. ⓒ Maize. ⓓ *Pinus*.

General Exam 8

Choose the correct answer (1 : 21) :

1 In the opposite figure, what is the gas that is supplied to green algae from the air pump ?

ⓐ CO_2 that is required for their respiration.
ⓑ O_2 that is required for their respiration.
ⓒ CO_2 that is required to perform photosynthesis process.
ⓓ O_2 that is required to perform photosynthesis process.

2 * What do you expect when examining a complete blood count for a woman suffering from general weakness, high rate of heartbeats and high respiration rate ?

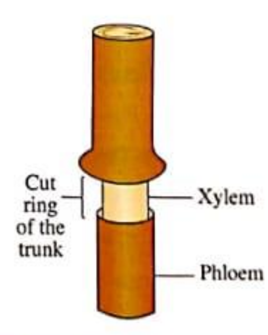
ⓐ An increase in the number of red blood corpuscles.
ⓑ An increase in the number of white blood corpuscles.
ⓒ A decrease in the number of red blood corpuscles.
ⓓ A decrease in the number of white blood corpuscles.

3 * Which of the following the amount of energy that is released from a fatty acid **doesn't** depend on it after completing Krebs cycle ?

ⓐ The number of acetyl groups that are resulted from its breaking down.
ⓑ The number of carbon atoms which enter in its composition.
ⓒ The accomplishment of electron transport chain.
ⓓ The number of coenzymes (A).

4 In the opposite figure, when removing a ring from the trunk of a plant, which of the following is expected to occur ?

ⓐ Water doesn't reach roots.
ⓑ Water doesn't reach leaves.
ⓒ Dissolved salts don't reach leaves.
ⓓ Amino acids and sugars are not transferred to roots.



26 **The opposite table illustrates** the relative percentages in the inhaled air, the exhaled air and the residual air in lung (the air in alveoli).

	Inhaled air	Exhaled air	Alveolar air
O_2%	21	16	14
CO_2%	0.03	4	5.5

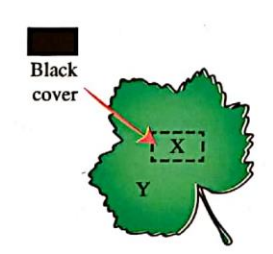
Explain how the differences occur in these components according to what happens in the two lungs.

____

____

____

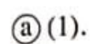
27 **In the opposite figure,** a black cover was put on part (X), then the leaf was exposed to light for several hours. **Conclude** what happens if some drops of iodine solution are put on parts (X) and (Y), after removing the black cover.



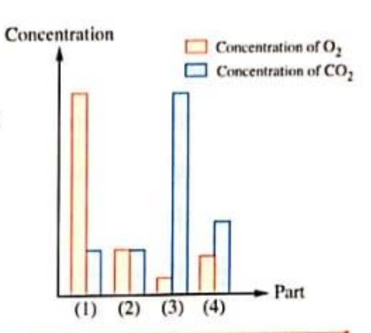
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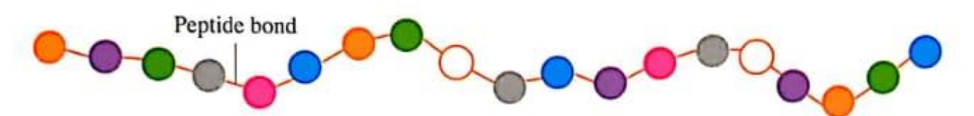


10 * The opposite graph represents the concentration of CO_2 and O_2 gases in blood in the different body parts, which of the following represents the blood flow through aorta ?



ⓐ (1). ⓑ (2).
ⓒ (3). ⓓ (4).

11 Study the following figure, then determine :



Which of the following ends the digestion of this compound completely ?

ⓐ Amylase in duodenum. ⓑ Pepsin in stomach.
ⓒ Trypsin in small intestine. ⓓ Peptidase in small intestine.

12 Which of the following substances **can't** be translocated through the phloem and xylem tissues ?

ⓐ Amino acids. ⓑ Sucrose.
ⓒ Starch. ⓓ H_2O

13 What is the similarity between the pulmonary artery and the limbs' veins ?

ⓐ Both of them contain oxygenated blood.
ⓑ Both of them contain deoxygenated blood.
ⓒ Both of them have valve.
ⓓ (b) and (c) together.

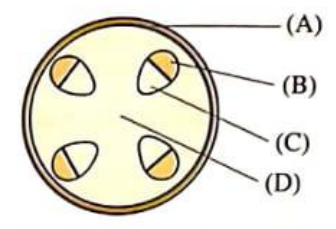
14 The following table shows the nutrients that are found in a piece of candy, which one of them **wouldn't** be digested ?

Sample	Nutrient	Amount (g)
ⓐ	Fats	3
ⓑ	Glucose	3
ⓒ	Protein	2
ⓓ	Starch	6

General Exam 7

Choose the correct answer (1 : 21) :

1 The opposite figure illustrates a diagrammatic section in the stem of a dicot plant, in which of the following tissues does sugar transfer ?



ⓐ (A). ⓑ (B).
ⓒ (C). ⓓ (D).

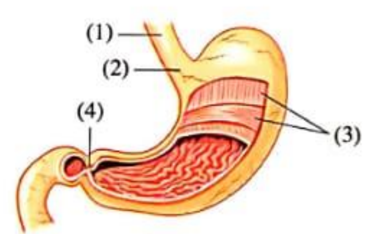
2 Which of the following is found in blood that is carried by the arterioles inside the lung ?

ⓐ Digested food.
ⓑ A higher percentage of O_2 than CO_2
ⓒ A higher percentage of CO_2 than O_2
ⓓ An equal percentage of CO_2 and O_2

3 * What is the number of the removed electrons from one molecule of glucose which contribute by their transfer from a higher energy level to a lower energy level in the electron transport chain ?

ⓐ 12 ⓑ 24 ⓒ 36 ⓓ 38

4 Some patients who have digestion complications suffer from the "Gastro-oesophageal reflux" which causes severe inflammation in the oesophagus, in which part in the opposite figure is the disturbance occurred to cause this ?



ⓐ (1). ⓑ (2).
ⓒ (3). ⓓ (4).

5 Which of the following valves determine the blood route which contains the highest percentage of oxyhaemoglobin substance ?

ⓐ Bicuspid valve and tricuspid valve.
ⓑ Bicuspid valve and aortic valve.
ⓒ Pulmonary valve and aortic valve.
ⓓ Bicuspid valve and pulmonary valve.

(10) What is the difference between the green plants and the purple sulphur bacteria ?

ⓐ The type of chlorophyll in each one of them only.

ⓑ The hydrogen source which is required to reduce CO_2 in each one of them only.

ⓒ The type of chlorophyll and the source of hydrogen required to reduce CO_2 in each one of them.

ⓓ Green plants are autotrophic, while purple sulphur bacteria are saprophytes.

(11) Which of the following vital processes **don't** need ATP ?

ⓐ Aerobic respiration.
ⓑ Glycolysis.
ⓒ Acidic fermentation.
ⓓ H_2O splitting in the photosynthesis process.

(12) "After eating too much salty popcorn, we feel roughness in the internal side of lips". What is the reason for that ?

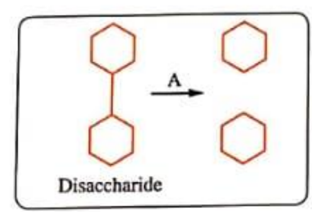
ⓐ Entry of salt into the lips' cells that leads to their swelling.

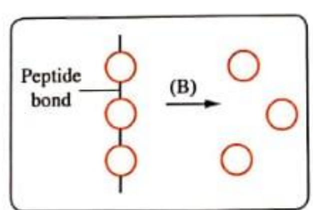
ⓑ Exit of salt from the lips' cells that leads to their shrinkage.

ⓒ Entry of water into the lips' cells that leads to their swelling.

ⓓ Exit of water from the lips' cells that leads to their shrinkage.

(13) Study the following diagram, then answer the following question :





What is the suitable value of pH for the activation of enzymes (A) and (B) together ?

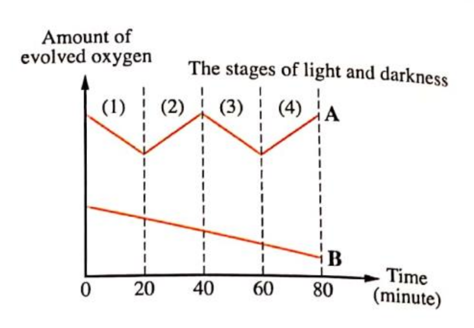
ⓐ 6 ⓑ 7 ⓒ 8 ⓓ 9

(14) What is the blood vessel which contains the highest percentage of fats after digestion and absorption processes ?

ⓐ Superior vena cava.
ⓑ Inferior vena cava.
ⓒ Hepatic portal vein.
ⓓ Hepatic vein.

EXAM
10

27 An aquatic plant was put in a medium containing water $H_2^{18}O$ and mineral salts, whereas water contains dissolved oxygen ($^{16}O_2$) and also a source of carbon dioxide ($C^{16}O_2$), then the plant exposed to light and darkness in a successive manner.



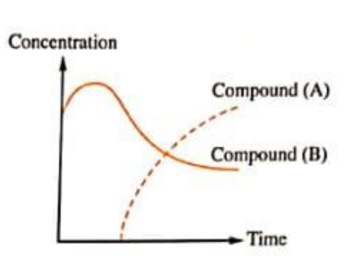
From the opposite graph :

(a) **Which** of the stages from (1) : (4) represents the darkness ?

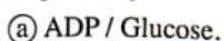
(b) **Which** curve represents oxygen (^{16}O) ?

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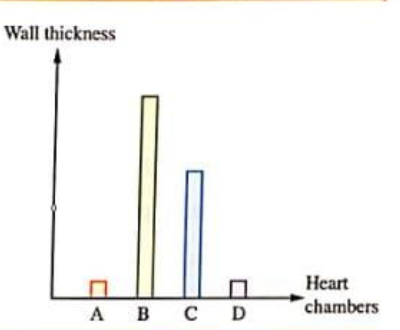
15 The opposite graph represents the concentration of two types of compounds in the thigh muscles, during performing vigorous exercises, which of the following expresses (A) and (B) respectively ?



ⓐ ADP / Glucose.
ⓑ Lactic acid / Glucose.
ⓒ Glycogen / ATP
ⓓ Glycogen / Lactic acid.



16 Study the opposite graph which shows the difference in the thickness of the heart chambers in human, what is the chamber that is represented by column (B) ?

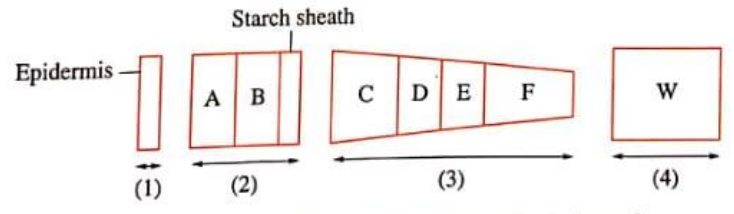


ⓐ Right atrium.
ⓑ Left ventricle.
ⓒ Left atrium.
ⓓ Right ventricle.

17 Which of the following expresses the characteristic features of the structures which are found in the cotton plant leaf's phloem ?

	Solutes concentration in the cell	Precipitation of lignin in the cell walls
ⓐ	Low	Low
ⓑ	Low	High
ⓒ	High	Absent
ⓓ	High	High

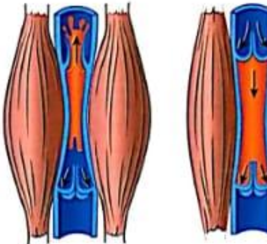
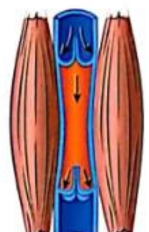
18 The following diagram shows 4 parts in the stem of a dicot plant arranged from outside to inside, study it then determine :



What is the function which the cells of the tissues (D) and (F) share ?

ⓐ Aeration.
ⓑ Elasticity.
ⓒ Sap storage.
ⓓ Sap transfer.

15 From studying the two opposite figures, what is the role of the muscles that surround the veins ?

ⓐ Opening the valve when the muscles contract.
ⓑ Opening the valve when the muscles relax.
ⓒ The closure of the valve when a muscle contracts and the opposite muscle relaxes.
ⓓ Opening of the valve when a muscle contracts and the opposite muscle relaxes.

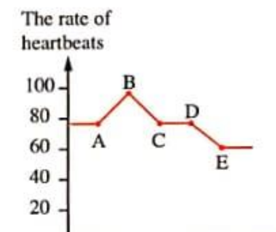
16 Study the following pathways :

• Alveolus ⟶ O_2 ⟶ Blood capillaries.
• Small intestine ⟶ Amino acids ⟶ Blood capillaries.
• Atmospheric air ⟶ CO_2 ⟶ Plant cells.

What is the common mechanism in transferring the substances in the previous pathways ?

ⓐ Active transport. ⓑ Osmosis. ⓒ Diffusion. ⓓ Imbibition.

17 Study the opposite graph which shows the heartbeats rate for a person during the day, then determine, what is the interval time that represents performing a physical activity ?



ⓐ AB ⓑ DE
ⓒ BC ⓓ CD

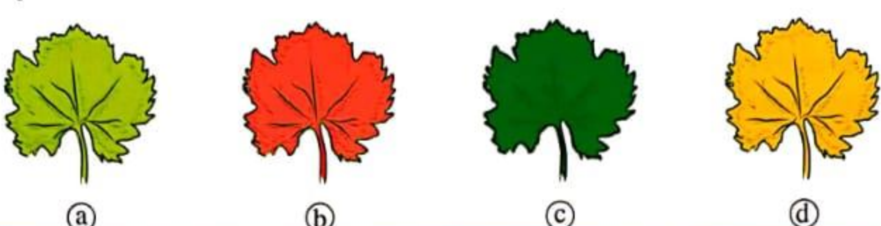
18 Which of the following substances **isn't** formed inside the liver ?

ⓐ Bile juice. ⓑ Heparin.
ⓒ Glycogen. ⓓ Lipase enzyme.

19 If the energy produced during the oxidation of a glucose molecule aerobically equals 2880 KJ. What is the expected amount of energy produced from a glucose molecule in a skeletal muscle during the anaerobic respiration ?

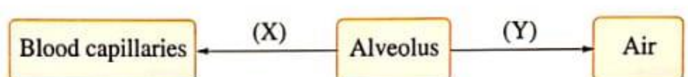
ⓐ 75 KJ ⓑ 150 KJ
ⓒ 300 KJ ⓓ 450 KJ

20 Which of the following plant leaves produces a greater amount of oxygen at daytime ?



ⓐ ⓑ ⓒ ⓓ

21 Study the following diagram :



Which of the following represents (X) and (Y) respectively ?

ⓐ CO_2 and O_2

ⓑ O_2 and CO_2

ⓒ Water vapour and O_2

ⓓ Water vapour and CO_2

Answer the following questions (22 : 27) :

22 **What is the similarity between :** glycolysis and Krebs cycle ?

23 **What is the difference between :** the epidermis in each of the root and stem ?

Answer the following questions (22 : 27) :

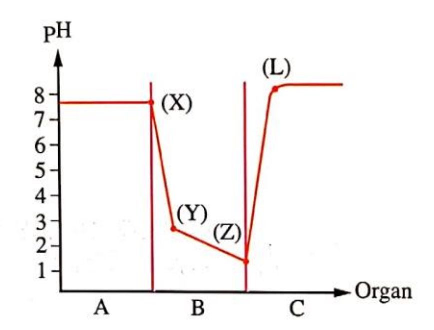
22 **Explain :** leaves represent the production lines, while phloem tissue represents the distribution lines in plant.

---

23 **What is the relation between :** the red blood cells and facilitating the digestion of fats ?

---

24 **The following graph illustrates three organs in the digestive canal (A), (B) and (C), illustrate the substance which is responsible for the change in pH from :**



(a) Point (X) to point (Y).

(b) Point (Z) to point (L).

---

25 **Suggest one reason for :** stopping the reactions of the electron transport chain.

---

20 What is the reason for the decrease in the plant absorption of salts when the soil is soaked with water ?

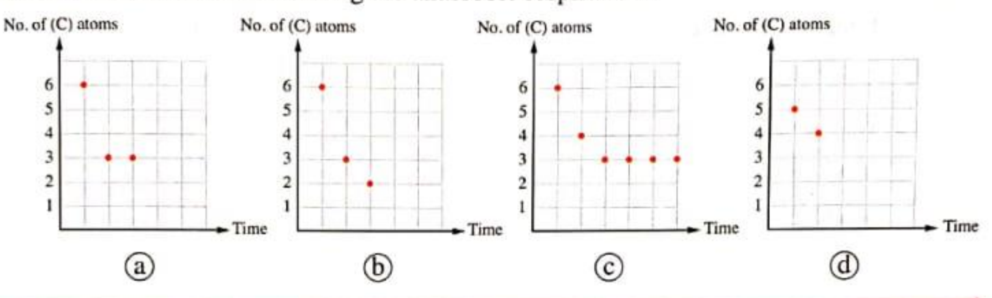
ⓐ Decreasing salts in the soil.

ⓑ Lack of O_2 in the soil.

ⓒ Increasing O_2 in the soil.

ⓓ Increasing in the production of ATP in the root cells.

21 * Which of the following graphs represents the reactions that happen to a glucose molecule in a muscle cell during the anaerobic respiration ?



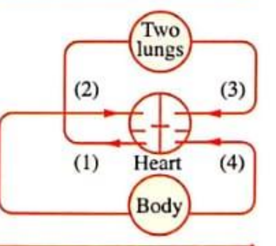
Answer the following questions (22 : 27) :

22 **Explain :** the root hairs are characterized by high osmotic pressures in the salty and desert soils.

____

____

23 **The opposite diagram** represents the blood circulation in human, which contains an arrow with wrong direction. **Determine** its name.



____

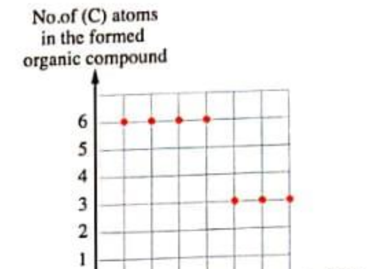
24 **Compare between :** the oxidation process for a piece of sugar in air and its oxidation inside a cell of a living organism's body.

____

____

____

15 * Study the opposite graph which describes the organic compounds that are formed during cellular respiration inside the cytoplasm of a living organism cell in case of O_2 deficiency, what is the living organism that performs this type of respiration ?



ⓐ *Paramicum.* ⓑ Bacteria.

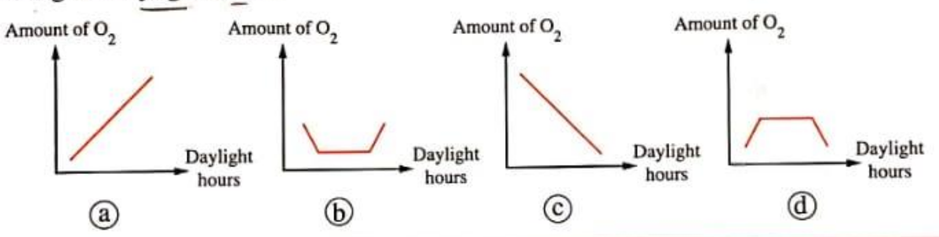
ⓒ *Amoeba.* ⓓ Yeast fungus.

16 Which body organ can form and destroy two types of blood components ?

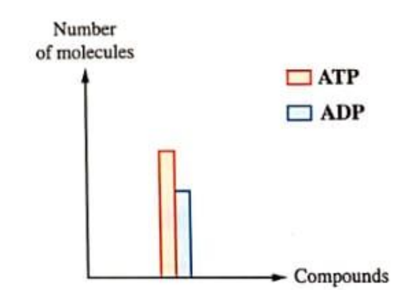
ⓐ Heart. ⓑ Liver.

ⓒ Pancreas. ⓓ Spleen.

17 Which of the following graphs describes the evolved O_2 amount from a plant during the daylight hours ?



18 * The opposite graph shows some of the photosynthesis process products, which of the following occurs during this stage ?



ⓐ The formation of H_2O molecules.

ⓑ The oxidation of $NADPH_2$

ⓒ The release of O_2

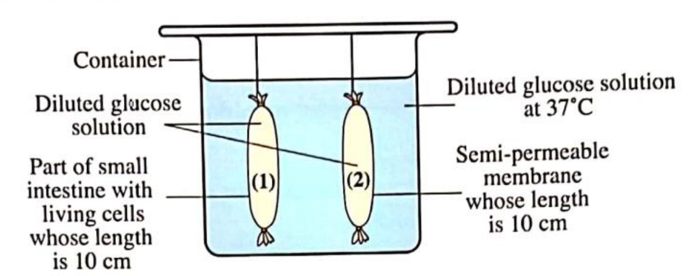
ⓓ The reduction of CO_2

19 In the presence of O_2 after performing a running race, the body works on ....

ⓐ oxidizing lactic acid. ⓑ oxidizing NADH

ⓒ reducing pyruvic acid. ⓓ ATP molecules decomposition.

27 **From the following figure :**



Deduce which of the two structures no. (1) or (2) contains a lower percentage of glucose concentration after two hours. **Explain your answer.**

____

____

General Exam 3

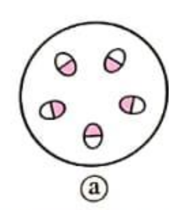
Choose the correct answer (1 : 21) :

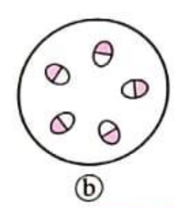
1 In which of the following blood vessels the highest concentration of amino acids is found after eating a meal rich in proteins ?

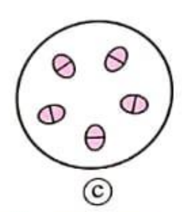
ⓐ Hepatic vein.
ⓑ Hepatic portal vein.
ⓒ Inferior vena cava.
ⓓ Superior vena cava.

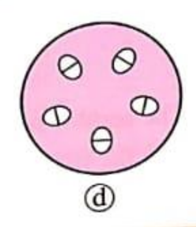
2 ❋ From the opposite figure, which of the following figures represents a transverse section in the stem of a dicot plant ?




ⓐ


ⓑ


ⓒ


ⓓ

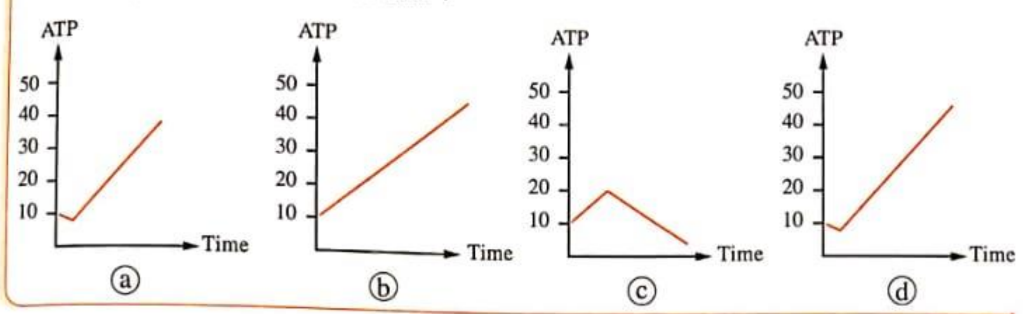
3 What happens when the number of the red blood corpuscles in an adult person reaches 3 million cells/mm^3 of blood ?

ⓐ The blood red colour intensity remains constant.
ⓑ The haemoglobin level increases in blood.
ⓒ The iron level increases in blood.
ⓓ The iron and haemoglobin level decreases in blood.

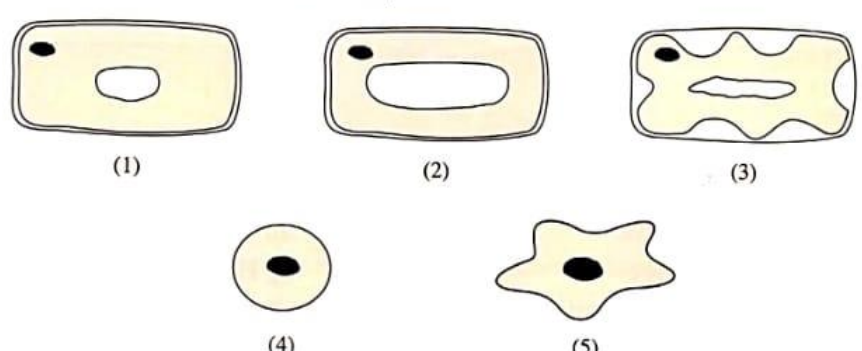
4 ❋ Which of the following is **not** related to the increase in the rates of elements diffusion against the concentration gradient ?

ⓐ The increase in the active transport.
ⓑ The plant needs more phosphorus.
ⓒ The absorption of macro-nutrients only.
ⓓ The increase in the respiration rates.

11 * If we supposed that the cell storage for energy is 10 ATP molecules, which of the following graphs represents the number of ATP molecules after the aerobic oxidation for one glucose molecule with time ?



12 The following figures show some plant and animal cells after placing them in two sucrose solutions that have different concentrations (knowing that their osmotic pressure = 0.5 % of the sucrose solution) :



Which of the previous cells were placed in these two solutions ?

	Sugar solution (0.1%)	Sugar solution (1%)
ⓐ	Cell (1) & Cell (2)	Cell (3) & Cell (5)
ⓑ	Cell (1) & Cell (4)	Cell (3)
ⓒ	Cell (2) & Cell (4)	Cell (1) & Cell (3)
ⓓ	Cell (3) & Cell (5)	Cell (2) & Cell (4)

13 What is the amount of protein that is found in each 100 cm^3 of plasma in a normal person ?

ⓐ 5 g. ⓑ 3 g.

ⓒ 7 g. ⓓ 9 g.

EXAM
8

Answer the following questions (22 : 27) :

22 Most of water that is absorbed by the plant evaporates.

Deduce what is the benefit from the small amount of water that the plant keeps.

---

23 **Explain :** proteins that are produced by the plant cells to perform the required vital processes can't penetrate through their plasma membranes.

---

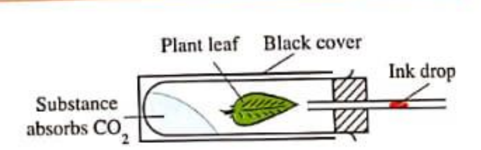
24 There is a reaction that links between glycolysis and Krebs cycle during the cellular respiration, **illustrate the products of this reaction.**

---

25 **What is the difference between :** the blood capillaries that are present in villi and that are present in the alveoli ?

---

26 **From the opposite figure :**



(a) **Determine** the direction of the ink drop movement in the tube.

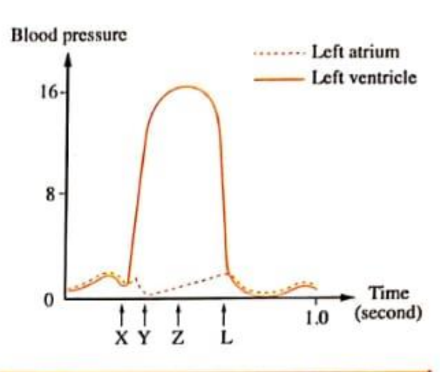
(b) **Explain** why the substance that absorbs CO_2 is added.

---

27 "Stomach has an important role in protecting the human body".

How far the statement is correct ? With explanation.

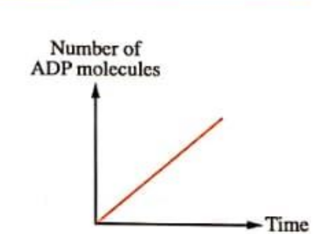
24 **The opposite graph** illustrates the changes in the blood pressure for each of the left atrium and left ventricle during the heart beating, **determine** the time at which the mitral valve opens.



25 **Explain :** the entrance of oxygen or air in the stem of a herbaceous plant is different from the woody stem.

26 "The role of enzymes is restricted on the digestion of food substances only".
How far the statement is correct ? With explanation.

27 **The opposite figure** illustrates the change in the number of ADP molecules in the cell over time, **is** the mentioned cell in an active state or not ? **Explain.**



9. Which of the following is found in the human blood plasma in the normal cases ?

ⓐ Fibrin.
ⓑ Thromboplastin.
ⓒ Thrombin.
ⓓ Fibrinogen.

10. Which of the following is(are) required for accomplishing the Krebs cycle in the presence of acetyl groups ?

ⓐ Glucose.
ⓑ Oxygen.
ⓒ Respiratory enzymes.
ⓓ ATP molecules.

11. Which of the following food substances **wouldn't** be digested, if it was treated with drops of the pancreatic juice that is present in the pancreatic duct ?

ⓐ Meat.
ⓑ Peanut butter.
ⓒ Bread.
ⓓ Rice.

12. * "The different food substances like sugar of sugarcane and amino acids transfer through the sieve tubes of phloem". Which of the following statements describes this process better ?

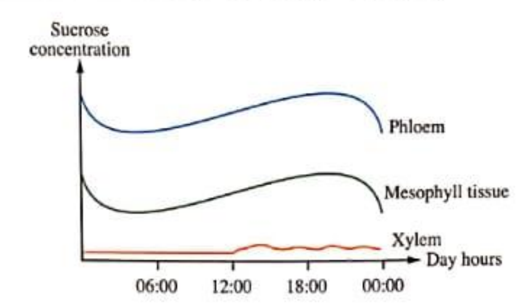
ⓐ Sugar transfers by active transport in some sieve tubes, while amino acids transfer by diffusion in the other sieve tubes.
ⓑ Sugar and amino acids transfer together by active transport in the same sieve tube of phloem.
ⓒ The flow rate of sugar and amino acids increases in two different directions in the same sieve tube of phloem.
ⓓ The flow rate of sugar and amino acids increases in different directions of different sieve tubes at the same time.

13. In the opposite figure, what is the pressure value in vessel (X) ?



ⓐ 10 mm Hg
ⓑ 70 mm Hg
ⓒ 130 mm Hg
ⓓ 160 mm Hg

15 ✻ The following graph shows the results of measuring sucrose concentration in three different tissues in the leaf of a dicot plant during 24 hours :



Which of the following can be concluded from that graph ?

ⓐ Water moves by osmosis from xylem tissue to phloem tissue.

ⓑ Sucrose moves by active transport from the mesophyll tissue of the leaves then to the phloem.

ⓒ Sucrose moves in both directions in the phloem.

ⓓ Xylem tissue uses sucrose sugar as a source of energy.

16 What is the similarity between the chloroplasts and mitochondria ?

ⓐ The presence of DNA molecules.

ⓑ The presence of NAD molecules.

ⓒ The production of sugar molecules.

ⓓ Glycolysis (splitting of glucose molecules).

17 "Babies' milk contains lactose sugar", how can the baby make benefit from this sugar ?

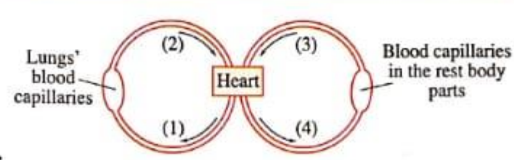
ⓐ Lactose is a delayed source for the energy production.

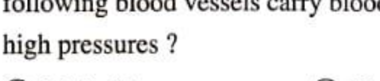
ⓑ Lactose transfers through cell membranes to be absorbed fastly.

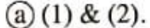
ⓒ Lactose contains higher stored energy than milk protein.

ⓓ The breaking down of chemical bonds among lactose molecules results in monosaccharides with high rate.

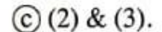
18 ✻ In the opposite figure, which of the following blood vessels carry blood at high pressures ?





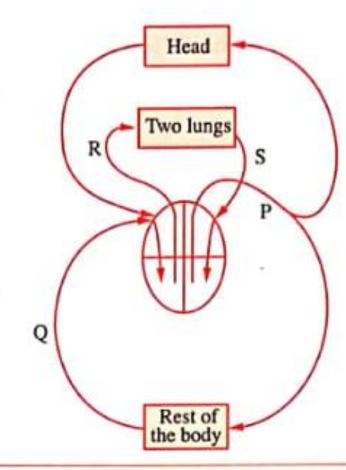


ⓐ (1) & (2). ⓑ (1) & (4).



ⓒ (2) & (3). ⓓ (2) & (4).

5 The opposite figure represents the heart and the main blood vessels, which of the following blood vessels has the highest blood pressure ?



ⓐ R

ⓑ S

ⓒ P

ⓓ Q

6 "The green plant is autotrophic", "it absorbs water and glucose from the soil", ...

ⓐ the two statements are correct and related.

ⓑ the two statements are correct and not related.

ⓒ the first statement is correct and the second statement is wrong.

ⓓ the first statement is wrong and the second statement is correct.

7 ✱ If 30 molecules of NADH are coming out from Krebs cycle to the electron transport chain, what is the number of pyruvic acid molecules which entered into the mitochondria to participate in the reactions ?

ⓐ 5 ⓑ 10

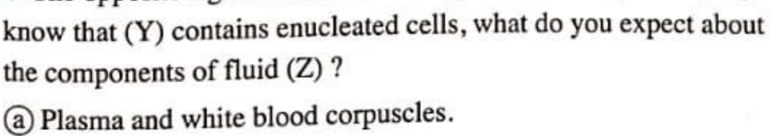
ⓒ 15 ⓓ 20

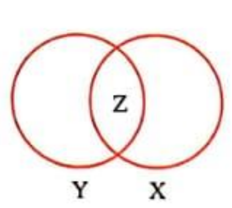
8 Which of the following elements is **not** present in the food of aphid insect, when it is examined ?

ⓐ Amino acids. ⓑ Fatty acids.

ⓒ Sucrose. ⓓ Water.

9 ✱ The opposite figure illustrates two types of the body fluids, if you know that (Y) contains enucleated cells, what do you expect about the components of fluid (Z) ?





ⓐ Plasma and white blood corpuscles.

ⓑ Lymph and plasma.

ⓒ Lymph and white blood corpuscles.

ⓓ Red blood corpuscles and blood platelets.